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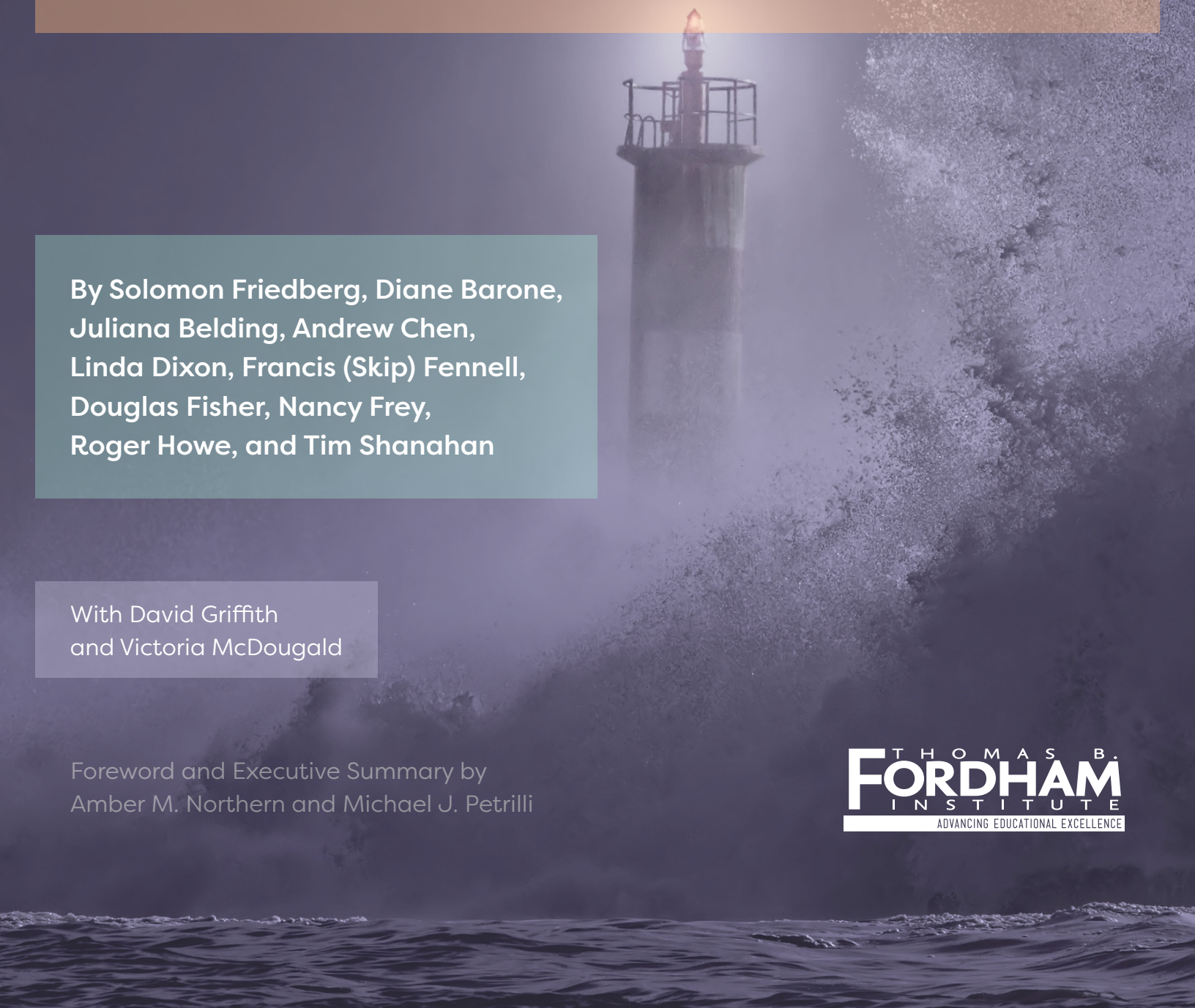
# THE STATE OF STATE STANDARDS POST-COMMON CORE




**By Solomon Friedberg, Diane Barone, Juliana Belding, Andrew Chen, Linda Dixon, Francis (Skip) Fennell, Douglas Fisher, Nancy Frey, Roger Howe, and Tim Shanahan**

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Foreword and Executive Summary by Amber M. Northern and Michael J. Petrilli



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# Contents

## Main Report



## State Reviews: English Language Arts

*by Diane Barone, Linda Dixon, Douglas Fisher, Nancy Frey, and Tim Shanahan*



## State Reviews: Mathematics

*by Solomon Friedberg, Juliana Belding, Andrew Chen, Francis (Skip) Fennell, and Roger Howe*



## Appendices

# Foreword & Executive Summary

By Amber M. Northern and Michael J. Petrilli

For the first decade of Fordham's existence, starting in 1997, reviewing state academic standards was our bread-and-butter. We would gather trusted subject-matter experts, request that they read all fifty sets of standards, and then ask them to offer their opinion. But the pattern was always the same: A few states had done a commendable job of identifying the knowledge and skills that students needed to master, grade-by-grade, to be considered on track for success. But most state standards were horrendous: poorly written, disorganized, and replete with dubious ideas. We would say so, and encourage these wayward states to adopt the exemplars as their own. Whether they took our advice was another story.

All that changed in 2010, when we read the final drafts of the Common Core State Standards (CCSS). Our *State of State Standards—and the Common Core—in 2010* found that the CCSS were clearer and more rigorous than the English language arts (ELA) standards in 37 states and stronger than the math standards in 39 states. Naturally, we encouraged those states to adopt the CCSS instead of starting from scratch.

This time, states took notice. Within a year, all but four had climbed aboard the Common Core train. But of course, it wasn't just that we had suddenly become more persuasive and influential. Lots of states had helped to develop the Common Core, so they were already "bought in" and happy to adopt them. And there were also those federal Race to the Top funds; states that adopted "common" college- and career-ready standards had a better shot at winning a piece of that tantalizing pie.

Even at the time, that last bit was rather worrisome. We had argued forever that "national" standards were a good idea—but would only be politically palatable if they avoided the stigma of "federal" involvement. Still, for several years, all was quiet. States started to implement the CCSS, and we were lulled into believing that we'd never need to evaluate state standards again. It was the "end of history"—at least when it came to battles over national standards.

Or so we thought.

As readers know, by 2013 the country was engulfed in a full-fledged culture war over the Common Core, with a loose coalition of populist conservatives teaming up with educational progressives in a push to dump the standards (and get out from under testing). Some states responded by "un-adopting" the Common Core; others tweaked, renamed, or rebranded them. But in general, the end of history was, alas, short-lived. So here we find ourselves, once again, evaluating state ELA and math standards.

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Why bother? What's the purpose of a review of state standards in 2018?

Quite simply, even the steadfast states have room for improvement. No matter how good they are, every state's academic standards need to be updated periodically to reflect the latest advances in content and pedagogy, as well as the lessons learned during their implementation. So the overarching goal of this report is to provide helpful guidance to states as they look to modernize their standards in the years ahead.

Because many states have kept the CCSS (or a variant thereof), this report—unlike our previous "state of the state standards" reports—does not formally review standards in all fifty states. Instead, it focuses on the subset of states that have made the *most* substantive changes to the CCSS, as well as those that never adopted them in the first place. By taking a close look at the standards in these states, plus a fresh look at the CCSS, it seeks to identify those changes and ideas that are worthy of broader adoption, as well as mistakes to avoid.

With those ends in mind, we assembled two teams of highly respected subject matter experts—one for ELA and one for math—with deep knowledge of the content standards in their respective fields.

Because these teams worked independently, their paths inevitably diverged. For example, because the ELA team saw evidence of substantive changes to more states' standards, it formally reviewed standards in fourteen states, while the math team limited itself to ten. And the two teams took different approaches to summarizing their findings. For example, the math team identified four "positive trends" that it attributed to the enduring influence of the CCSS—as well as important exceptions to those trends. However, our ELA reviewers were more inclined to see unwanted patterns in the data, as demonstrated by the six "persistent shortcomings" they identified, which include several areas where they see evidence of "backsliding" since the adoption of the Common Core.

Due to the differences between our review teams, as well as the inherent differences between English language arts and math, we advise against comparisons between or across the two subjects, and against simplistic or reductive readings of either team's findings. Ultimately, what matters most is where states go from here—and what they do with the information and recommendations in this report.

## ELA Results

Although no set of ELA standards received a perfect score, the CCSS-ELA once again earned a 9 out of 10, reflecting the consensus among our reviewers that they are generally a "strong" set of standards that states can and should continue to implement (Table 1).

Our reviewers also rated seven states' ELA standards "good" because they earned scores of 7 or 8 (Indiana, Kansas, New York, North Carolina, Oklahoma, Pennsylvania, and West Virginia) and were worthy of implementation with "targeted revisions." Of the standards in this group, our reviewers found Indiana's to be particularly commendable.

Further down the spectrum, five states earned overall scores of 5 or 6 and were thus deemed to have "weak" standards (Arizona, Nebraska, South Carolina, Tennessee, and Texas). Our reviewers recommend that these standards be significantly revised before educators and policymakers devote any more effort to their implementation.

Finally, two states—Missouri and Virginia—earned overall scores of 4, indicating that their ELA standards are "inadequate" and should be completely overhauled as soon as possible.

## Math Results

Overall, the pattern for math is similar to that of ELA. Again, no set of standards received a perfect score (Table 2). However, both the CCSS-M and Texas's math standards earned a 9 out of 10, reflecting the consensus among our reviewers that they are "strong" and worthy of implementation.

Below those two exemplars are three states that earned overall scores of 7 (Indiana, Tennessee, and Virginia), meaning their standards are "good" and should be implemented with "targeted revisions."

Further down the spectrum are five states (Minnesota, Missouri, Nebraska, North Carolina, and Oklahoma) that earned overall scores of 5 or 6. According to our reviewers, these states' math standards are "weak" and should not be implemented without "significant revisions."

Finally, one state—Pennsylvania—earned an overall score of 4, meaning that its math standards are "inadequate" in the eyes of our reviewers and should be completely re-written.

As Table 1 and Table 2 make clear, most states that "un-adopted" or made non-trivial changes to the Common Core replaced them with standards that were substantially weaker in both subjects. In general, these states would have been better off if they had simply adopted the Common Core without making any revisions.

## Table 1. State Standards Ratings: English Language Arts

| | Content & Rigor (out of 7) | Clarity & Specificity (out of 3) | Total Score (out of 10) | Overall Rating |
|---|---|---|---|---|
| Common Core ELA | 6 | 3 | 9 | Strong |
| Indiana | 6 | 2 | 8 | Good |
| Kansas | 6 | 1 | 7 | Good |
| New York | 5 | 2 | 7 | Good |
| North Carolina | 5 | 2 | 7 | Good |
| Oklahoma | 4 | 3 | 7 | Good |
| Pennsylvania | 4 | 3 | 7 | Good |
| West Virginia | 5 | 2 | 7 | Good |
| Arizona | 4 | 2 | 6 | Weak |
| South Carolina | 4 | 2 | 6 | Weak |
| Texas | 5 | 1 | 6 | Weak |
| Nebraska | 3 | 2 | 5 | Weak |
| Tennessee | 4 | 1 | 5 | Weak |
| Missouri | 3 | 1 | 4 | Inadequate |
| Virginia | 2 | 2 | 4 | Inadequate |

## Table 2. State Standards Ratings: Mathematics

| | Content & Rigor* (out of 7) | Clarity & Specificity* (out of 3) | Total Score (out of 10) | Overall Rating |
|---|---|---|---|---|
| Common Core Math | 7 | 2 | 9 | Strong |
| Texas | 7 | 2 | 9 | Strong |
| Indiana | 5 | 2 | 7 | Good |
| Tennessee | 5 | 2 | 7 | Good |
| Virginia | 4 | 3 | 7 | Good |
| Minnesota | 4 | 2 | 6 | Weak |
| North Carolina | 5 | 1 | 6 | Weak |
| Missouri | 4 | 1 | 5 | Weak |
| Nebraska | 3 | 2 | 5 | Weak |
| Oklahoma | 3 | 2 | 5 | Weak |
| Pennsylvania | 3 | 1 | 4 | Inadequate |

** Referred to more broadly as Content and Communication in the mathematics standards reviews.*

# National Trends in ELA Standards

After completing their reviews, our ELA reviewers identified two positive trends in state ELA standards:

1. ***More states are prioritizing writing, including foundational writing skills*** such as printing, keyboarding, phonics, and spelling.
2. ***More states are emphasizing vocabulary development*** including word meanings, roots and affixes, context clues, and connotation and denotation.

Unfortunately, these positive developments are at least partially overshadowed by six persistent failings, though note that (for the most part) these criticisms do not apply to the majority of states that adopted the CCSS-ELA and chose not to make substantive revisions to their standards in recent years. The failings identified by our reviewers include:

1. ***A marked retreat from rigorous quantitative and qualitative expectations for reading and text complexity***, a development that leaves educators in the dark about what types of texts students should be reading, and at what levels.
2. ***A lack of disciplinary literacy standards*** showing how literacy skills extend beyond the English classroom into other subjects such as history, science, and mathematics.
3. ***A lack of clear skill progressions between grade levels, especially at the high school level,*** and a lack of strong college- and career-readiness (CCR) standards to anchor K–12 expectations.
4. ***Insufficient guidance on the specific types of literary and informational texts and genres/subgenres to which students should be exposed***, such as drama and literary criticism, or satire and epic poetry.
5. ***A focus on writing processes rather than measurable student outcomes***, which leaves educators with insufficient guidance regarding the frequency, length, and type of writing assignments.
6. ***A dearth of supporting documents that are critical to implementation***, such as glossaries of key terms, specific guidance for determining text complexity, and lists of exemplar texts.

As the length of this list suggests, there is substantial room for improvement in some states' ELA standards. However, in many cases, the shortcomings our reviewers identify could be addressed through straightforward additions and clarifications, rather than a complete overhaul of existing standards.

# National Trends in Math Standards

Like the ELA team, the math team identified several trends in state standards, all of which are at least partly attributable to the enduring influence of the CCSS-M. These include:

1. ***A stronger focus on arithmetic in grades K–5***, where the priority should be ensuring students' mastery of foundational skills, such as counting and flexibly computing with whole numbers, decimals, and fractions, as well as their understanding of the place value principle.
2. ***More coherent treatment of proportionality and linearity in middle school***, including rates and ratios, slope, and linear relationships and functions (e.g., $y = mx + b$).
3. ***An appropriate balance between conceptual understanding, procedural fluency, and application***, each of which is an essential dimension of mathematical thinking.
4. ***Better organization and teacher supports***, including focused introductions for individual grade levels and courses, mathematically coherent organizational approaches that highlight the connections between standards, and helpful ancillary materials.

All of this counts as good news. However, as suggested by the low scores that some states' math standards received, there are more exceptions to these trends than one would want to see. For example, some states do not explicitly require students to know their addition and multiplication facts from memory, while others make no mention of proficiency in the standard algorithms for the four major operations. Similarly, some states still have incoherent (or partially coherent) middle school progressions that fail to make the appropriate connections between interrelated

standards and topics. And some give short shrift to conceptual understanding at all grade levels. Finally, some states have poorly organized standards, while others fail to include process or practice standards that describe the "essential mathematical habits of mind" that all students should learn—or fail to connect those habits to content.

# For States that Kept the Common Core

Specific recommendations for those states that made the most significant changes to the Common Core (or that never adopted it in the first place) can be found in the individual reviews that comprise *Section IV*. In nearly every case, the simplest "fix" would be for these states to adopt (or re-adopt) the Common Core. However, since there would be little point in restarting that fight, the individual reviews meet these states halfway by describing the *specific* changes they could make to address the weaknesses in their current standards. States with weaker standards are encouraged to make changes based on this information.

But what of the majority of states that have kept the CCSS, or a close facsimile thereof? In general, the question facing these states is not whether to scrap their standards but how to build on them. So with that mind, we have three broad recommendations for states that are part of this group, including subject-specific guidance as appropriate.

## 1 Focus on implementation.

Insofar as they have chosen to stick with the Common Core, most states now have excellent ELA and math standards. So, policymakers would do well to remember the most famous principle of sound medicine: "First, do no harm." Any improvements to ELA or math standards in these states are likely to have (at most) a minor impact on student achievement, and recent experience suggests that ill-advised revisions have the potential to do considerable damage.

To be clear, the CCSS are not perfect, and states that have stuck with them can and should learn from the minor revisions and additions that other states have made. But the need for revisions is not urgent. So in addition to considering the recommendations below, we advise states with solid standards to devote their resources to implementing them well. Replacing the general "all-purpose" professional development that many teachers currently receive with sustained, coherent, and *subject-specific* professional development focused on ELA and math content (and pedagogy) would be a good first step.

## 2 Adopt the improvements that other states have made to support implementation.

In recent years, numerous states have embellished the Common Core with a wide variety of supporting documents and minor additions—in most cases, without attempting a fundamental rewrite. Although the quality of these innovations varies, some of them are well done. In particular, the efforts of California and Massachusetts are worth highlighting.

On the ELA side, Massachusetts has added over 100 grade-specific examples to its grade level content standards, in an effort to make them more concrete. In general, the quality of these examples is high, and their presentation is straightforward and user-friendly. Similarly, California has made some useful additions to its standards for Writing. For example, students are now expected to "write routinely over extended... and shorter time frames" starting in grade 2 rather than grade 3, and the standards for higher grades include more detailed expectations related to thesis statements (grade 6) and dealing with counterarguments (grade 7). Additions to the Speaking and Listening standards also emphasize logic and critical thinking. For example, fifth-grade students are expected to "identify and analyze any logical fallacies" in a speaker's presentation.

On the math side, Massachusetts has added a description of the Mathematical Practice Standards by grade band that includes specific examples of connections between the content and practice standards (in addition to revising and updating its glossary and bibliography). However, perhaps the most important innovations are at the high school level, where California and Massachusetts have effectively integrated the CCSS-M high school standards (which are presented by conceptual category) with *Appendix A* of the CCSS-M (which provides options for organizing those standards into courses), thus providing a coherent and thorough treatment of high school content and pathways that is ideal for implementation. (The Golden State also includes excellent standards for AP Probability and Statistics and for Calculus courses, while the Commonwealth includes model Precalculus and Advanced Quantitative Reasoning courses.)

## 3 If possible, take the next step by precisely addressing specific limitations of the CCSS-ELA and CCSS-M.

In addition to adopting the improvements identified above, some states should consider taking the next step by addressing some of the other weaknesses our reviewers identify—especially if doing so involves making well-conceived additions, rather than disturbing the delicate internal logic of the existing standards. Specifically, states that feel confident in their ability to manage this process should take the following steps:

### a *Develop disciplinary literacy standards for Speaking and Listening, and for Language, and further develop the disciplinary literacy aspect of the ELA standards for grades 6–12.*

Each discipline uses language in particular ways to create, disseminate, and evaluate knowledge. So it's important that students develop an understanding of these differences. As noted in our updated review, however, the Literacy Standards in History/Social Studies, Science, and Technical Subjects (i.e., the Common Core's "disciplinary literacy" standards) could be strengthened, especially in grades 6–12. Most obviously, states could develop specific standards in Speaking and Listening, and in Language, since both of these domains are omitted entirely from the current disciplinary literacy standards.

### b *Define the differences in expectations between 9th and 10th grade and between 11th and 12th grade in ELA.*

At the high school level, the CCSS-ELA standards are divided into two-year grade bands (9–10 and 11–12) "to allow schools, districts, and states flexibility in high school course design." However, reviewers found that this lack of specificity resulted in redundancies across grade levels, making it difficult for teachers to know which standards to cover in which grade, or how the rigor of individual standards ought to increase from one grade to the next. Consequently, states should consider creating grade-specific English language arts standards for high school such that each grade has specific expectations.

### c *Articulate clear pathways in high school math that are explicitly aligned with specific post-secondary and labor market outcomes.*

Currently, most states list standards for specific high school math courses, but are not clear about how these courses fit together and what they prepare a student to do post-graduation. Ideally, standards would indicate which pathways prepare students for STEM or other quantitative college majors, for the intellectual demands of completing college with a non-STEM major, and for technical and non-technical fields that may not require a four-year degree. Regardless of the path they choose, all students should learn algebra, geometry, and statistics and probability —and every student should take four years of high school math.

### d *Take another look at the alignment between K–12 and pre-K.*

Although a comprehensive review of states' pre-K standards is beyond the scope of this report, both review teams noted that a few states (including Massachusetts) had made a conscious effort to align their pre-K and K–12 standards—something that is clearly desirable in principle. Because it has been more than a decade since most states adopted their pre-K standards, the potential for some sort of misalignment is considerable. Consequently, states that have yet to do so may want to take another look at this issue in consultation with early childhood experts.

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Our reviewers, as well as those of us at Fordham, believe that the Common Core standards have aged well. Still, we must remember that standards are only words on paper if they don't inspire great instruction in the classroom. And on that front, there is clearly more work to be done, as we have learned from various implementation studies, including Fordham's own *Reading and Writing in America's Schools* (2018).[1]

Confusion still reigns in too many places: Do the standards expect young students to learn history, science, and other subjects in order to become better readers? (Yes.) Do they require high school English teachers to ditch classic works of literature? (No.) Do they want young children to master their math facts? (Yes.)

The standards, we believe, are clear and on target, on these and other important points. But something is getting lost in translation. Fixing that problem is as urgent as ever.

# Acknowledgments

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We would also like to thank the many individuals who made this endeavor possible. First and foremost, we are deeply grateful to our lead reviewers, Solomon Friedberg (Math: Boston College) and Diane Barone (ELA: University of Nevada, Reno), who capably led their respective teams and promptly addressed our myriad questions and requests. And we are similarly grateful for the diligence and patience of our other math reviewers, including Juliana Belding (Boston College), Andrew Chen (EduTron), Francis (Skip) Fennell (McDaniel College), and Roger Howe (Yale and Texas A&M). We are also deeply grateful to the rest of our hard working ELA team, including Linda Dixon (Colton Joint Unified School District), Douglas Fisher (San Diego State University), Nancy Frey (San Diego State University), and Tim Shanahan (University of Illinois at Chicago).

At Fordham, we are especially grateful for the efforts of David Griffith and Victoria McDougald, who were responsible for coordinating the Math and ELA teams, respectively—and for helping to edit this voluminous report. We also extend our gratitude to Chester E. Finn, Jr. for reviewing drafts, to Nicholas Munyan-Penney for handling funder communications, and to Jonathan Lutton for designing the layout of the report and managing its production. Fordham research intern Emily Howell provided invaluable assistance at various stages in the process. Finally, we thank Shannon Last for copyediting the report.

1. D. Griffith, *Reading and Writing Instruction in America's Schools*, Thomas B. Fordham Institute (2018), accessed from https://edexcellence.net/publications/reading-and-writing-instruction-in-americas-schools

Section I

# Introduction

It has been eight years since the Thomas B. Fordham Institute compared states' English language arts (ELA) and mathematics standards to what were then the newly minted Common Core State Standards (CCSS). Yet the questions that ought to concern policymakers and the public have not changed: *Are states' ELA and math standards as good as they need to be? And how might they be improved?*

Because many states have kept the Common Core standards (or a close facsimile thereof), this report—unlike previous "state of the state standards" reports—does not formally review standards in all fifty states. Instead, it focuses on the subset of states that have made substantive changes to the Common Core, as well as those that never adopted them in the first place. More specifically, it seeks to update our understanding of state ELA and math standards based on our reviews of fourteen state ELA standards and ten state math standards, as well as the original CCSS.

To that end, the rest of this report is organized as follows: The remainder of *Section I* provides an overview of our methods. *Section II* summarizes our results, as well as the positive and negative trends across states. *Section III* offers specific guidance for states that are looking to revise or update their standards. Finally, *Section IV* presents the individual reviews.

## Methods

In the summer of 2017, Fordham staff located each state's most recently adopted English language arts and mathematics standards on state department of education (DOE) websites, and confirmed what we found by checking with state DOE representatives. (To the best of our knowledge, they are current as of December 2017.) At the same time, we recruited five math and five ELA experts to serve as our reviewers. Each of these review teams comprised individuals who are widely recognized as subject matter specialists and who possess deep knowledge of the content standards in their respective fields. On the math side, they include lead reviewer Solomon Friedberg (Boston College), Juliana Belding (Boston College), Andrew Chen (EduTron), Francis (Skip) Fennell (McDaniel College), and Roger Howe (Yale and Texas A&M). On the ELA side, they include lead reviewer Diane Barone (University of Nevada, Reno), Linda Dixon (Colton Joint Unified School District), Nancy Frey (San Diego State University), Douglas Fisher (San Diego State University), and Timothy Shanahan (University of Illinois at Chicago). (See *Appendix A* for reviewer bios.) We met with each team to determine the scope of the project, develop evaluation criteria and scoring conventions, and complete sample review exercises to calibrate vetting and scoring across reviewers.

## Key Differences Between the 2010 and 2018 Criteria

In light of the improvements that many states have made to their standards in the last eight years, both teams stiffened their criteria for this review.

In particular, the ELA team made the following revisions to the 2010 ELA criteria:

1. Specified as "crucial content" the following: foundational knowledge, comprehension of literary and informational texts, vocabulary, language, fluency, writing, text complexity, and disciplinary literacy.
2. Specified that ELA standards should focus on learning outcomes, not processes.
3. Specified that ELA standards should connect to other disciplines such as art, science, and social studies.

Similarly, the math team made the following revisions to the 2010 math criteria:

1. Provided additional detail regarding place value, fractions, geometry, and statistics and probability (in light of the ever-increasing role of data in society).
2. Replaced the section on Problem-Solving with a section on the Development of Mathematical Thinking and Practices, and specified that standards should address such practices and integrate them with content.
3. Removed the section on STEM-Ready Standards on the grounds that our criteria already included significant STEM-Ready content (such as logarithms and trigonometric functions).[2]
4. Toughened the scoring criteria by specifying that standards omitting "some" crucial content should receive a 5 rather than a 6 while removing the quantitative measures of content shortfall (e.g., "at least 5 percent and up to 20 percent" of crucial content is missing), as well as the distinctions between individual content scores (e.g., 6 and 7) to make the scoring process more authentic.
5. Added the expectation that standards and any related materials be available, identifiable, and accessible on the Internet.

We began by updating the evaluation criteria from our most recent (2010) round of state standard reviews to reflect the latest research on ELA and mathematics instruction, as well as the expertise of a new group of reviewers (see *Key Differences Between the 2010 and 2018 Criteria*). Because we have new evaluation criteria and new reviewers, the scores from this report and our 2010 report are not directly comparable (see *Review and Scoring Criteria*).

After reaching a consensus on the criteria, reviewers conducted a preliminary review of ELA and math standards in all fifty states to determine which states should undergo a full evaluation. In general, states with minor rewordings and/or clarifications to the CCSS were excluded, since the updated Common Core review in this report would also apply to them. Conversely, states with numerous and substantive additions, subtractions, or other changes were reviewed—in addition to those states that never adopted the CCSS.

To be clear, there is no bright line between these groups, since determining "substantive" change is inherently subjective. Nor does the inclusion and exclusion of particular states imply the existence of such a line. Finally, because the two review teams worked independently (and because some states made more changes to their ELA standards than their math standards), a handful of states were included for ELA but not for math (and in Minnesota's case, only math was reviewed).

After scanning every state's standards, our review teams ultimately selected fourteen for an ELA review and ten for a math review, in addition to conducting fresh reviews of the CCSS.

## Review and Scoring Criteria

Academic standards are the foundation upon which much of public education rests, so it's critical that they achieve two overarching goals: First, they must capture the essential content that students need to know for each grade level or band. Second, they must effectively communicate that content to educators, parents, curriculum writers, and other stakeholders. Accordingly, the review criteria for both ELA and mathematics focus on two categories: "content and rigor" and "clarity and specificity" (referred to as "communication" in the math reviews).

2. Despite this change, reviewers identified missing STEM-ready content as a weakness of several states' math standards.

On the ELA side, content-specific criteria are organized into four categories: Reading, Writing, Listening and Speaking, and Research. To receive a high score for content and rigor, ELA standards must focus on learning outcomes over processes; include explicit text complexity definitions/explanations; specify the genres and subgenres to be learned; articulate specific foundational skills to be mastered; address disciplinary literacy standards; and include digital and multimedia sources, among other criteria. (See *Appendix B* for the full ELA criteria.)

On the math side, content-specific criteria are organized into six categories: Whole Numbers, Fractions, Measurement and Data, Algebra, Geometry, and Statistics and Probability. To receive a high score for content and rigor, math standards must address the appropriate grade level topics in each of these domains in a focused, coherent, and rigorous manner, while also integrating and promoting the "math processes" or mathematical habits of mind that every student should possess. (See *Appendix C* for the full math criteria.)

In addition to being rated on their content and rigor, the ELA and math standards were also evaluated on clarity and specificity—a category that includes factors such as the overall organization of a state's standards and how user-friendly they are, in addition to how clearly they are written and whether they are sufficiently detailed and specific. Essentially, this bucket asks the question that matters most for implementation: *Are the standards understandable and useful to educators, parents, and other stakeholders—in addition to experts?*

After much deliberation, both review teams decided to focus on the actual text of the standards, rather than the sometimes voluminous support materials that some states have developed to accompany them. However, in the few cases where such materials were needed to make sense of the standards—and were explicitly cross-referenced in them—they were included in the review.

Based on the above criteria, states could receive a maximum of 10 points, including 7 for content and rigor, and 3 for clarity and specificity/communication. States with standards that receive a total score of 9 or 10 are deemed "strong to excellent" and worthy of full implementation. A score of 7 or 8 signifies that those standards are "good," but should be implemented with targeted revisions. A score of 5 or 6 means that the state's standards are weak and require significant revisions. Finally, a 4 or lower indicates inadequate standards that require a total rewrite before implementation.

The scoring system for this report differs slightly from the system that was used in the 2010 report (which also included letter grades).

Section II

# Findings

This section presents state- and national-level findings for ELA and math. For each subject, we first present scores for individual states (and the CCSS), along with a brief description of the "2018 Best in Class" standards, which is followed by a longer discussion of the positive trends in standards across the country, as well as the persistent failings or common mistakes that states should address or avoid as they revise their standards in the coming years. General guidance for states as they revise their standards is available in *Section III*. Full reviews of individual states (including state-specific recommendations) can be found in *Section IV*.

## English Language Arts

Scores for ELA standards are shown in Table 3.

Although no set of ELA standards received a perfect score, the CCSS-ELA earned a 9 out of 10, reflecting the consensus among reviewers that they are generally a "strong" set of standards that states should continue to implement.

Similarly, our reviewers rated seven states' ELA standards "good" and worthy of implementation with targeted revisions (Indiana, Kansas, New York, North Carolina, Oklahoma, Pennsylvania, and West Virginia). Of the standards in this group, reviewers found Indiana's to be particularly commendable.

Further down the spectrum, five states earned overall scores of 5 or 6 and were deemed to have "weak" standards (Arizona, Nebraska, South Carolina, Tennessee, and Texas). Our reviewers recommend that these standards be significantly revised before educators and policymakers in these states devote any more effort to their implementation.

Finally, two states—Missouri and Virginia—earned overall scores of 4, indicating that their current ELA standards are "inadequate" and should be completely overhauled before they do further damage to teaching and learning.

### "Best in Class"

Though no set of ELA standards earned perfect marks, the CCSS-ELA and Indiana earned the highest scores. Overall, these standards do a good job of describing the key content, knowledge, and skills that are imperative for success in college or career, focusing on measurable student learning outcomes over learning processes, and using clear language that is easy for teachers and other stakeholders to understand.

Of this best-in-class duo, only the CCSS-ELA received a total score of 9, including a 6 for content and rigor and a 3 for clarity and specificity. Notable strengths of the CCSS-ELA include a clear emphasis on foundational literacy skills in the early grades, and on reading comprehension and vocabulary throughout K–12. In addition, the CCSS-ELA provides specific guidance on what constitutes a "complex text," how to measure text complexity, and how those requirements need to shift as students move from one grade to the next.

Finally, the secondary-level standards include a nascent attempt to address disciplinary literacy—that is, specialized literacy skills in areas such as history, social studies, and technical subjects—though these standards could be further developed. Overall, the CCSS-ELA are clearly written, well-organized, and appropriately detailed, with a consistent focus on measurable student learning outcomes (as opposed to processes).

## Table 3. State Standards Ratings: English Language Arts

| | Content & Rigor (out of 7) | Clarity & Specificity (out of 3) | Total Score (out of 10) | Overall Rating |
|---|---|---|---|---|
| Common Core ELA | 6 | 3 | 9 | Strong |
| Indiana | 6 | 2 | 8 | Good |
| Kansas | 6 | 1 | 7 | Good |
| New York | 5 | 2 | 7 | Good |
| North Carolina | 5 | 2 | 7 | Good |
| Oklahoma | 4 | 3 | 7 | Good |
| Pennsylvania | 4 | 3 | 7 | Good |
| West Virginia | 5 | 2 | 7 | Good |
| Arizona | 4 | 2 | 6 | Weak |
| South Carolina | 4 | 2 | 6 | Weak |
| Texas | 5 | 1 | 6 | Weak |
| Nebraska | 3 | 2 | 5 | Weak |
| Tennessee | 4 | 1 | 5 | Weak |
| Missouri | 3 | 1 | 4 | Inadequate |
| Virginia | 2 | 2 | 4 | Inadequate |

Like the CCSS-ELA, Indiana's ELA standards are admirably thorough and well-written, earning them a score of 8 overall, including a 6 for content and rigor and a 2 for clarity and specificity. Indiana's standards for foundational literacy skills in reading and writing are comprehensive and consistent with current research findings. Its Reading Literature, Reading Nonfiction, and Writing standards are rigorous and thorough, as is the development of a separate vocabulary strand. Finally, the Hoosier state's standards address reading and writing in various disciplines, and do a commendable job articulating how these expectations progress across grade levels.

To be clear, neither the Indiana standards nor the CCSS-ELA is perfect. For example, Indiana should consider revisions that clarify what is meant by "grade-level texts," set explicit quantitative and qualitative expectations for text complexity, and provide exemplar texts for all grade levels. Similarly, states using the CCSS-ELA should consider revising the Literacy in History/Social Studies, Science, and Technical Subjects standards to include specific standards in Speaking and Listening, and in Language, in addition to further developing their disciplinary literacy standards in high school. Finally, both Indiana and the CCSS-ELA would benefit from the addition of grade-specific English language arts standards in high school. (For more, see the guidance in *Section III* and the full reviews in *Section IV*.)

# National Trends (ELA)

Thanks to the widespread adoption of the CCSS-ELA, our nation's ELA standards are stronger today than they were a decade ago. Yet, as noted previously, even the CCSS-ELA are not perfect, and in some states they have sustained serious damage in the years since their adoption (if they were adopted at all). Consequently, although it begins with a brief discussion of some noteworthy positive trends, this section focuses primarily on the "persistent failings" in many states' ELA standards—that is, the areas where a significant number of states could still improve.

## + Positive Trend 1:

*Increased emphasis on writing and inclusion of foundational writing skills*

In general, the reviews suggest an increased emphasis on writing. For example, fourth-grade students in Oklahoma are expected to "write facts about a subject, including a clear main idea with supporting details, and use transitional and signal words" (4.3.W.2). Similarly, twelfth-grade students are expected to "(1) introduce precise, informed claims, (2) distinguish them from alternate or opposing claims, (3) organize claims, counterclaims, and evidence in a way that provides a logical sequence for the entire argument, and (4) provide the most relevant evidences to develop balanced arguments, using credible sources" (12.3.W.4).

Foundational writing skills are now included in several states' standards. For example, in Arizona, a foundational writing strand was added for grades K–5, which calls for students to develop basic writing skills that are essential underpinnings of composition (e.g., spelling, phonics, and handwriting). This foundation helps ensure that students learn why writing is important, how to write, and how to generate writing ideas.

## + Positive Trend 2:

*Increased emphasis on vocabulary development*

Another laudable trend is the inclusion of specific standards devoted solely to vocabulary development. For example, second-grade students in South Carolina are expected to "determine the meaning of a newly formed word when a known affix is added to a known word" (2.RL.10.2, 2.RI.9.2), while students in fourth and fifth grade are expected to "determine the meaning of an unknown word using knowledge of base words and Greek and Latin affixes" (4.RL.10.2, 4.RI.9.2, 5.RL.10.2, 5.RI.9.2).

Similarly, despite being inadequate in other areas, Virginia's vocabulary standards are extensive and specific, covering topics such as denotation, connotation, and morphology (the study of how words are formed in language). And vocabulary also appears as an important element for conveying information in writing and improving one's craft. For example, fourth graders are expected to "revise writing for clarity of content using specific vocabulary and information" (4.7.m), while fifth graders are expected to "use precise and descriptive vocabulary to create tone and voice" (5.7.j).

## − Persistent Failing 1:

*A marked retreat from rigorous quantitative and qualitative expectations for reading and text complexity*

Studies show that large percentages of graduating seniors in the United States are unable to read the types of texts that they will encounter in college and the workplace. So it's a serious problem if standards are vague when it comes to the types and levels of texts that students should be able to navigate. In the absence of grade-specific guidance regarding text complexity, teachers must rely on personal or local expectations to guide their selections, and the meaning of "grade-level text" may vary drastically from one school (or district) to another.

In light of these concerns, many states have adopted standards that specify the text levels at which students should be able to read—yet others have not. In fact, one of the broadest and most alarming trends that we observe is a marked retreat from such expectations in states that initially adopted the CCSS-ELA.

Some states (such as Virginia) are silent regarding text difficulty. Others (such as New York and South Carolina) expect students to read "grade-level" texts, but do not specify the quantitative or qualitative criteria that texts must satisfy to be considered grade-level texts. And still other states (such as Kansas and Pennsylvania) don't set clear text complexity expectations within their standards documents, choosing instead to include resources on text complexity measures elsewhere on their website (or refer users to CCSS-ELA's 2010 *Appendix A* on text complexity, as Pennsylvania does). Though better than no guidance, such information would be much more helpful if included in or linked directly from the standards.

There are multiple ways that states can make text complexity requirements specific, including adopting quantitative measures of readability. Absent that, they might provide a list of exemplar texts that demonstrate the level of complexity students should be able to handle. Yet not many states are doing that either (see Persistent Failing 4).

## − Persistent Failing 2:

*The absence of disciplinary literacy standards*

Each academic discipline—from biology to anthropology—uses language in particular ways to create, disseminate, and evaluate knowledge. For example, the conventions and

expectations of scientific journals are different from those of a literary magazine. Yet although many states mention literacy in disciplines or content areas other than language arts, few detail the specific textual features or reading and writing approaches that students must master to read or write sophisticated texts that are appropriate to other disciplines. For example, although students in Kansas are expected to write "for a range of discipline-specific tasks" starting in 3rd grade (W.3.12), and to attend to "norms and conventions of the discipline" starting in high school (W.9-10.1.d, W.9-10.2.e), no other guidance or expectations are provided. And Virginia's disciplinary literacy standards are even more confusing and incomplete. (Although they note that students are to read in other subjects, there is no recognition of the specialized nature of texts or reading purposes/approaches in these other fields.)

By failing to show how reading, writing, language, and speaking/listening extend beyond the English classroom, these standards leave students ill-prepared to master the advanced literacy skills they will need in college and the workplace, which become increasingly specialized over time. In contrast, the CCSS-ELA include clearly articulated expectations for disciplinary literacy.

## Persistent Failing 3:

### *A lack of clear skill progressions between grade levels and/or a lack of strong CCR standards to anchor skills progressions*

In many states, a lack of clear skill progressions between grade levels is a serious issue, especially at the high school level. For example, many states and the CCSS-ELA band their ninth- and tenth-grade and eleventh- and twelfth-grade standards together (thus reducing four years of secondary expectations to two levels). And some states' standards are redundant within or across these grade bands, as demonstrated by the following West Virginia standards:

- *Analyze how complex characters (e.g., those with multiple or conflicting motivations) develop over the course of a literary text, interact with other characters, and* ***advance*** *the plot or develop the theme (9.3).*
- *Analyze how complex characters (e.g., those with multiple or conflicting motivations) develop over the course of a literary text, interact with other characters, and* ***affect*** *the plot or develop the theme (10.3).*

It's not clear what the difference between advancing and affecting the plot is supposed to be (or if the difference in wording is even intentional). Similarly, the bolded text in the following Missouri standard applies to eleventh- and twelfth-grade students, but not to those in ninth and tenth grade.

> *Draw conclusions, infer, and analyze by citing relevant and thorough textual evidence to support analysis of what the text says explicitly as well as inferences drawn from the text,* ***including where the text leaves matters uncertain*** *(11–12.R.1.A).*

Again, the value of this addition isn't clear, and this sort of redundancy makes it less likely that students will be exposed to more complex texts as they move through school.

In addition to such redundancies, many states fail to include strong college- and career-readiness (CCR) standards that "anchor" their K–12 standards by defining the skill level expected of graduates who are (as the term implies) college- and career-ready. For example, although Pennsylvania's standards claim to "focus on college- and career-readiness," such capstone standards are never articulated. And Nebraska has just four broad and unhelpfully vague CCR standards, including "students will learn and apply reading skills and strategies to comprehend text" and "students will learn and apply writing skills to communicate."

Unfortunately, although the Common Core's CCR standards are intended to anchor the K–12 expectations, they too have internal inconsistencies that can obscure the intent. For example, one standard for reading literature in kindergarten expects students to "recognize common types of texts" (RL.K.5). However, the corresponding standard for reading informational text expects them to "identify the front cover, back cover, and title page of a book" (RI.K.5). These are two highly disparate skills, yet they fall under the same CCR standard.

## Persistent Failing 4:

### *A lack of guidance on specific types of literary and informational texts and genres/subgenres*

Strong ELA standards address both literary and informational reading (e.g., literary nonfiction). However, many states' academic standards continue to treat literary reading in a general manner, with scant attention paid to the reading and writing of different genres, subgenres, and types of text. And when states do specify the genres that students need

to be able to comprehend (e.g., fiction, poetry, drama), they usually offer insufficient guidance on subgenres (e.g., epic poems, satires, parodies). This weakness is also evident in standards on informational text (e.g., speeches, literary criticism). For example, Missouri's standards do not specify subgenre requirements in the elementary grades or genre reading requirements in grades 6–12 for informational texts.

In many state standards, a lack of exemplar texts compounds the sparse detail imparted to genres and subgenres. Suggested texts should be offered for all literary, informational, and other discipline-specific materials at all grades. Yet states such as Arizona, Kansas, Missouri, New York, and Virginia have *no requirements* that students be familiar with any particular works of literature, authors, or historical documents—exemplary or otherwise. Although states often stress that these omissions are intended to leave curricular choices to local schools, this lack of guidance makes it harder for teachers to choose grade-level texts.

Among them, these unfortunate silences on subgenres, exemplars, and text requirements in general make it less likely that students will be exposed to appropriately rigorous texts—much less to a shared body of knowledge—and seriously undermine the rigor of many states' standards.

## – Persistent Failing 5:

### *Vague and/or process-writing standards that are not measurable*

Despite the increased emphasis on writing noted above, many ELA standards still suffer from vague or confusing writing standards that focus on activities, processes (e.g., "brainstorming"), or experiences, as opposed to measurable learning outcomes. For example, Nebraska's standards note only that writing tasks should be "of increasing length and complexity" starting with third grade (LA 3.2.1.g).

The preponderance of Texas's Composing and Research standards focus on writing processes. For example, students are expected to "revise drafts for clarity, development, organization, style, word choice, and sentence variety" (6.10.C). While such standards ensure that students have certain writing *experiences*, they fail to specify how well students should be able to write. Similarly, Virginia's writing standards conflate processes, expectations, and learning outcome standards by asking students in grades 3–8 to "plan, draft, revise, and edit" or to use "prewriting strategies," while providing little direction as to the frequency or amount of writing that students are expected to produce. This unhelpful mixing of process and outcome goals skirts what it means to be an effective writer, and makes the standards difficult to implement effectively.

In contrast, the Common Core's writing standards are primarily dedicated to outcomes, rather than processes. For example, eighth-grade students are expected to "write arguments to support claims with clear reasons and relevant evidence" (W.8.1). Moreover, they are expected to "acknowledge and distinguish the claim(s) from alternate or opposing claims, and organize the reasons and evidence logically" (W.8.1a), in addition to "using accurate, credible sources and demonstrating an understanding of the topic or text" (W.8.1b), and using "words, phrases, and clauses to create cohesion and clarify the relationships among claim(s), counterclaims, reasons, and evidence" (W.8.1c).

(Helpfully, the CCSS-ELA writing standards are paired with reading standards so there are clear connections between reading and writing outcomes.)

## – Persistent Failing 6:

### *A lack of critical supporting documents to aid implementation*

Most of the issues above are compounded by a lack of ancillary guidance for students, teachers, curriculum directors, test developers, and/or textbook writers (such as one finds on the CCSS-ELA website). The need for such supplementary documents varies by state. For example, some states want students to develop grade-level phonological awareness and decoding skills in the primary grades, but do not specify which of these skills should be developed when. Similarly, most states need more information about the determination of text complexity, or to provide lists of exemplar texts representing various genres and disciplines that are appropriate for a given grade level. For states that already provide these resources in an appendix or elsewhere, cross-referencing or otherwise internally referring to them is critical. For example, Pennsylvania's appendices contain valuable information, but this is easily overlooked when not directly referenced or linked within the standards themselves.

# Mathematics

Scores for math standards are shown in Table 4.

Overall, the pattern for math is similar to the pattern for ELA. Again, no set of standards received a perfect score. However, the CCSS-M earned a 9, as did Texas, signaling that these standards are "strong" and worthy of implementation without significant revision.

Slightly below the two exemplars are three states that earned overall scores of 7 (Indiana, Tennessee, and Virginia), meaning that their standards are "good" and should be implemented with targeted revisions. Following behind are five others (Missouri, Minnesota, Nebraska, North Carolina, and Oklahoma) that earned overall scores of 5 or 6. These states' math standards are considered "weak" and should not be implemented without significant revisions.

Finally, one state—Pennsylvania—earned an overall score of 4, meaning that its math standards are "inadequate" in the eyes of our reviewers and should be completely re-written before they do further damage.

## "Best in Class"

Of the math standards reviewed for this study, two—the CCSS-M and the Texas Essential Knowledge and Skills (TEKS)—are strong enough to serve as exemplars.

Both standards do an excellent job with the math at each grade level. For example, both focus on arithmetic in grades K–5, with a thorough treatment of place value and the standard algorithms, and a thoughtful approach to fractions. Similarly, both standards provide a coherent treatment of proportionality and linearity in the middle grades, as well as a systematic development of geometry and statistics. Finally, both include a full treatment of algebra, geometry, and basic probability and statistics in their high school courses. In addition to these strengths, at all grade levels, both the CCSS-M and the TEKS support the development of conceptual understanding, procedural fluency, and application (through modeling and problem solving), as well as the integration of mathematical practices with mathematical content.

## Table 4. State Standards Ratings: Mathematics

| | Content & Rigor* (out of 7) | Clarity & Specificity* (out of 3) | Total Score (out of 10) | Overall Rating |
|---|---|---|---|---|
| Common Core Math | 7 | 2 | 9 | Strong |
| Texas | 7 | 2 | 9 | Strong |
| Indiana | 5 | 2 | 7 | Good |
| Tennessee | 5 | 2 | 7 | Good |
| Virginia | 4 | 3 | 7 | Good |
| Minnesota | 4 | 2 | 6 | Weak |
| North Carolina | 5 | 1 | 6 | Weak |
| Missouri | 4 | 1 | 5 | Weak |
| Nebraska | 3 | 2 | 5 | Weak |
| Oklahoma | 3 | 2 | 5 | Weak |
| Pennsylvania | 3 | 1 | 4 | Inadequate |

** Referred to more broadly as Content and Communication in the mathematics standards reviews.*

As noted in our review, the CCSS-M have several particularly excellent features when it comes to organization and communication. For example, each grade (K–8) and each content area (in high school) begins with a lucid introduction that effectively communicates the big picture, including the most critical areas of instruction. And the specific math content standards that follow these introductions are clear and appropriately detailed, with helpful examples for teachers and other stakeholders. Texas's math standards are less detailed and explanatory. But they do a very good job of specifying the outcomes that are expected of students, and the website that houses the TEKS includes a significant amount of supplementary material that is easy to find.

# National Trends (Math)

Overall, mathematics standards in the United States are far stronger today than they were in 2010, when Fordham conducted its last fifty-state review. And much of this improvement is due to the CCSS-M, which earned a rating of A- in the 2010 report and a score of 9 out of 10 in this one. In general, the states with the strongest math standards are the thirty-five to forty states that have built on the CCSS-M, modified it in minor ways, or independently drafted separate standards that mirror the pacing and organization of the CCSS-M. As indicated in the introduction, it's imperative that those states continue to take the implementation of their standards seriously and support teachers—operationally, instructionally, and fiscally—in carrying them out.

At the same time, significant weaknesses remain in some states' standards—especially if they chose not to adopt or build on the CCSS-M—but also in other cases, because they made unnecessary and poorly conceived changes to what is a carefully thought out and impressively rigorous set of standards. This is not to say that every modification of the CCSS-M is poor or that every non-CCSS-M set of standards is inadequate (as demonstrated by our review of Texas, which did an exemplary job on its own). Still, in most states that have diverged appreciably from the CCSS-M, the result has not been an improvement.

Below we highlight four critical areas where the majority of states have made important progress and the various ways in which a minority continues to lag behind.

## + Positive Trend 1:

### *Stronger focus on arithmetic in grades K–5*

Because it is the foundation for much of the mathematics that students will encounter in higher grades, experts agree that arithmetic should be the primary focus of math instruction in grades K–5. Yet in 2010, the biggest problem we identified in state math standards was that arithmetic was not a priority. Back then, mathematicians Steven Wilson and Gabrielle Martino lamented,

> *Many states include solid arithmetic standards, but these are buried among a multitude of distracting and less important content... By failing to clearly prioritize this essential content, states fail to ensure that it gets the attention it deserves. Only a few states either explicitly or implicitly set arithmetic as a top priority. More often, states devote fewer than 30 percent of their standards in crucial elementary grades to arithmetic.*

Thanks in large part to the CCSS-M, this is no longer true. To the contrary, a focus on arithmetic is now evident in many states' K–5 math standards. For example, most states' standards begin with a clear focus on counting, whole numbers, and place value. And from the earliest grades, addition and subtraction facts are connected to the "base-10" number system. Similarly, most states expect students to know their single-digit addition and multiplication facts, as well as the related subtraction and division facts, and to be proficient with the standard algorithms for these operations, as well as strategies related to place value and the properties of operations. Finally, most states systematically develop a strong understanding of fractions and decimals.

Topics such as geometry and measurement, the representation of data, and algebraic reasoning are also included in most states' elementary standards. However, in strong standards these topics are connected to number and operations—enhancing rather than diluting the focus on arithmetic. For example, length measurement, leading to the number line, is used to interpret and unify conceptions of addition and subtraction, and to relate numbers of different types (whole numbers, fractions, decimals, signed numbers). Similarly, area models are used to interpret and understand multiplication.

## Exceptions to Trend 1

Notwithstanding the progress noted above, a few states continue to fall short when it comes to basic arithmetic. For example, by the end of second grade, students in Pennsylvania are expected to "use mental strategies to add and subtract within 20" (2.2.2.A.2). Yet they are never specifically required to know from memory all sums of two single-digit numbers, or to add and subtract "automatically" or "fluently" within 20. Nor are they expected to know from memory all products of two single-digit numbers within 100. (At least five other states—including Minnesota, North Carolina, North Dakota, and Virginia—make some version of this mistake.) Though math experts continue to debate the wording of such expectations, there is little disagreement about the importance of these "math facts." Similarly, experts agree that students must be familiar with a variety of techniques if they are to compute fluently and accurately, including the standard algorithms for the four arithmetic operations. Yet some state standards instead require students to learn *a* standard algorithm[3] or to use algorithms.[4] Insofar as they are intended to soften or undermine the expectation that students know the standard algorithm (in addition to other approaches) these alternative wordings have the potential to do serious damage.

On an equally serious note, some states should improve their development of fractions—a topic that has historically given them trouble. For example, Nebraska and Pennsylvania devote too little attention to the role of unit fractions, while Missouri skips several important steps in fractional arithmetic, including various forms of equivalence (e.g., between fractions and whole numbers). Missouri omits several common representations of fractions, making it less likely that students will understand what fractions are and how they arise.

In addition to these omissions, some states fail to maintain an appropriate pace in the elementary grades. For example, first graders in Arizona are only expected to add and subtract within 10 rather than 20, thus needlessly delaying their understanding of the base-10 system. Similarly, although almost every state expects students to multiply and divide fluently within 100 by the end of third grade, Minnesota defers this expectation until fourth grade and doesn't address division with remainders until fifth grade.

## Positive Trend 2:

### *More coherent treatment of proportionality and linearity in middle school*

The study of fractions is closely tied to proportional relationships and reasoning (involving rates and ratios). And such reasoning, in turn, provides students with a platform for understanding slopes and linear relationships (e.g., $y=mx+b$), which are a key foundation for algebra.[5] Thus, the sequence and pacing of these topics is critical to helping students move from elementary to middle to high school mathematics.

In recent years, the treatment of all of these topics has improved in many states. For example, in most states that used the CCSS-M as a starting point, ratios and proportional relationships is a main topic in grades 6 and 7, slope is developed in grade 7, and linear equations are an important part of grade 8, where they are both analyzed and used to describe linear relationships for bivariate data. Similarly, in Texas's standards, proportionality is a main topic in grades 6 and 7, linear equations are treated in grade 7, and the formal treatment of slope—though delayed until grade 8—is impressively thorough. Despite their differences, both of these approaches are strong because they are fundamentally coherent, meaning that the order, pacing, and presentation of topics help teachers and students understand the connections between them.

## Exceptions to Trend 2

Despite these improvements, there are still problems with some states' middle and high school progressions. For example, Nebraska defers several topics that are usually covered in grade 8 to later grades, including linear relationships and functions. Similarly, North Carolina's admirably thorough treatment of unit rates and ratios for proportional relationships ought to serve as a foundation for the concept of slope, yet the standards on slope never explicitly make this connection.[6]

3. See New York's and South Carolina's mathematics standards.
4. See the mathematics standards adopted by Minnesota, Oklahoma, and Tennessee; also, Pennsylvania does not specify the standard algorithm.
5. For example, the National Math Advisory Panel recommended that students be familiar with the slope of a line by the end of grade 7.
6. See North Carolina mathematics standards 6.RP.2, 7.RP1, NC.8.F.4.

## + Positive Trend 3:

### *An appropriate balance between conceptual understanding, procedural fluency, and application*

Years ago, experts quarreled over the relative importance of students' conceptual understanding, procedural fluency, and ability to apply what they have learned. Yet, as the 2008 National Math Advisory Panel noted in its final report,

> *To prepare students for Algebra, the curriculum must simultaneously develop conceptual understanding, computational fluency, and problem solving skills. Debates regarding the relative importance of these aspects of mathematical knowledge are misguided.*[7]

Thankfully, judging from their current math standards, most states have embraced the importance of each of these capacities and the implicit compromise represented by the quote. For example, the introduction to the CCSS-M states that "Mathematical understanding and procedural skill are equally important" while also asking students to "make sense of problems and persevere in solving them." Similarly, teachers in Texas are charged with "focusing on computational thinking, mathematical fluency, and solid understanding" so that students can become "successful problem solvers."

The tripartite mission articulated in these documents is also evident in the standards themselves. For example, most states now ask students to explain their reasoning, in addition to performing computations and solving problems. And most states' high school frameworks include modeling, which links classroom math and statistics to everyday life, work, and decision making, in addition to standards about formal mathematical proof and carrying out mathematical procedures accurately.

## − Exceptions to Trend 3

When the balance between conceptual understanding, procedural fluency, and applications is off—as is still the case in some states—it is conceptual understanding that is most likely to be shortchanged. For example, although geometry is a prime area for developing mathematical thinking, the words "proof" and "prove" do not appear in any of Pennsylvania's high school geometry standards.[8] Similarly, the word "understand" does not appear in any of Nebraska's standards for grades 4–11, and the word "explain" is used only once in each of grades 5–8, with unfortunate consequences for important topics. (For example, the third-grade standards mention the distributive property, but don't ask students to understand or explain it.)

In a similar vein, although the word "understand" appears repeatedly in the Introduction and Front Matter of Virginia's standards, the "curriculum frameworks" that are the heart of that state's standards focus heavily on the mechanics of computing, estimating, and performing operations, as well as real-world applications—as opposed to conceptual understanding. Because the generalities about understanding in Virginia's standards aren't buttressed by individual standards, they are thus unlikely to be reflected in Virginia's classrooms. Similarly, many Oklahoma standards expect students to "understand" a concept, process, or application. However, in about half of these cases, the related sub-standards (or "objectives") are purely procedural, suggesting that the conceptual goal is unlikely to be met.

Finally, a different imbalance is found in Florida's high school standards, which omit mathematical modeling as a conceptual category. This raises the concern that real-world applications are being underemphasized.

## + Positive Trend 4:

### *Better organization and teacher supports*

Well-organized math standards do at least two things: First, they provide an account of key themes for each grade level or course, as well as a list of major benchmarks to ensure that instruction is appropriately focused. Second, they are organized in a mathematically coherent way that makes clear how mathematical topics fit together within a grade or course and how they are connected to prior and future work. In addition to this organizational transparency, strong math standards typically include ancillary materials that support teachers in their work (such as a glossary or other documents that aid with interpretation).

The CCSS-M are a clear example of well-organized standards. For example, prior to the content standards for each grade level (K–8), there is an introduction describing the focus for

7. See *National Math Advisory Panel: Final Report*, accessed from https://www2.ed.gov/about/bdscomm/list/mathpanel/report/final-report.pdf#page=19.
8. They do appear in, for example, Anchor Descriptor G.1.3.2.

the grade and a bulleted list of critical topics. Similarly, each high school domain (or area of math) includes a narrative introduction, followed by the individual standards for each of the clusters in that domain. In general, the organization of the CCSS-M into domains and clusters supports coherence by providing teachers and other stakeholders with conceptual cues about the connections among individual standards and about the intended learning progressions within and across grade levels. Helpfully, states such as Massachusetts and California have extended these positive features to high school courses (see *Section III*).

In addition to content standards, most states have adopted practice or process standards, reflecting the broad consensus among math experts that there are certain mathematical habits of mind that educators at all levels should seek to develop in students. For example, the CCSS-M include eight Standards for Mathematical Practice, abbreviated versions of which are listed in the introduction to each grade (K–8) and high school category. And even states that are clearly non-CCSS-M—such as Nebraska, Oklahoma, and Texas—have practice or process standards. Some states have even expanded on the approach taken by the CCSS-M.

For example, Massachusetts articulates particular expectations for each of three grade spans: pre-K–5, 6–8, and 9–12 (see *Section III*).

In addition to the supports described above, most states include a mathematical glossary in their standards, as well as other resources and links. Though the forms and content of these resources are too diverse to summarize here, many are likely to be useful for teachers. For example, a number of states have developed "vertical alignment charts" that describe the desired progressions for particular topics across grades, and there is a "wiring diagram" for the CCSS-M showing connections across both topics and grades.

## Exceptions to Trend 4

Despite the various improvements noted above, poor or inadequate organization is still a major problem in some state standards, including several that have inexplicably weakened the organizational structure of the CCSS-M (often while retaining much of their content). For example, Florida, Minnesota, Missouri, Pennsylvania, and South Carolina all lack introductions or overviews for individual grades or courses, which are typically used to specify the most critical areas within each grade or course. Similarly, the North Dakota and Pennsylvania standards lack narratives for each high school domain, making the progression within these domains less clear. And South Carolina's standards lack cluster headings, which typically provide conceptual cues for the connections and coherent progressions within clusters.

In addition to these gaps, some states employ a strange or sloppy organization that is likely to be confusing for teachers. For example, the North Carolina standards don't highlight the focal points for each grade, but there are two sets of accompanying documents that do so ("critical areas" and "major work"). And Nebraska's standards are sometimes incoherent because the same mathematical topics appear in multiple categories, sub-categories, and/or grades, leaving teachers on their own when it comes to identifying standards that are part of the same broader topic.

Some states' content standards are simply too broad or cryptic to provide useful guidance to teachers. For example, Pennsylvania asks second graders to "use place-value understanding and properties of operations to perform multi-digit arithmetic" but declines to elaborate (CC.2.1.4.B.2).[9] And in Missouri and Virginia, more specific information can be found in supporting documents. However, this format only works if these documents are clearly linked to the standards themselves and appropriately updated when a state revises its standards. For example, consider the following Missouri standards:

- *Interpret products of whole numbers (3.RA.A.1).*
- *Interpret quotients of whole numbers (3.RA.A.2).*
- *Prove theorems about lines and angles (G.CO.C.8).*
- *Prove theorems about triangles (G.CO.C.9).*
- *Prove theorems about polygons (G.CO.C.10).*

By themselves, these statements are of little use to teachers. Yet Missouri does not provide clear links to supporting documents (such as its Expanded Expectations) within its standards.

In addition to these organizational issues, some state standards lack common support materials. For example, at least ten states lack glossaries in their mathematics standards, while New York's glossary is limited to a short list of verbs associated with the state's standards.

9. See Pennsylvania mathematics standard CC.2.1.4.B.2.

Finally, some states make little effort to establish expectations for math practices or processes. For example, Florida and Missouri have chosen not to adopt practice standards, while Minnesota's process standards and Pennsylvania's practice standards are just short phrases (e.g., "Attend to precision") that are never explained or illustrated. Somewhat less egregiously, Nebraska and North Carolina never explicitly connect their practice standards to their content standards (though the former are often implicit in standards that ask students to interpret, model, or explain their reasoning).

Section III

# Guidance for States

What approach should states take to updating their ELA and math standards, in light of the findings in *Section II*?

As indicated by their total scores and ratings, most states that either failed to adopt or made non-trivial changes to the Common Core State Standards replaced them with standards that were weaker in both subjects. Still, not all changes or choices are created equal: In ELA, Indiana, Kansas, New York, North Carolina, Oklahoma, Pennsylvania, and West Virginia made choices that still resulted in decent standards. But that wasn't the case in Arizona, Missouri, Nebraska, South Carolina, Tennessee, Texas, and Virginia, whose new ELA standards are a clear step backwards. Similarly, Indiana, Tennessee, Texas, and Virginia have good math standards, but the same cannot be said of Minnesota, Missouri, Nebraska, North Carolina, Oklahoma, or Pennsylvania. In general, these states would have been better off if they had adopted the Common Core without making any revisions.

Obviously, the simplest solution for all of these states would be to adopt (or re-adopt) those standards. However, as noted in the *Foreword and Executive Summary*, there would be little point in relitigating that fight. So rather than seeking to do so, the individual reviews in the final section of this report meet states halfway by describing the specific changes they ought to make to address the weaknesses in their current standards. States with weaker standards are encouraged to make changes based on this information.

But what of the majority of states that have kept the CCSS, or a close facsimile thereof? In general, the question facing these states is not whether to scrap their standards but how to build on them. So with that mind, we have three broad recommendations for states that are part of this group, including subject-specific guidance as appropriate.

## For States that Kept the Common Core

### 1 Focus on implementation.

Insofar as they have chosen to stick with the Common Core, most states now have excellent ELA and math standards. So, policymakers would do well to remember the most famous principle of sound medicine: "First, do no harm." Any improvements to ELA or math standards in these states are likely to have (at most) a minor impact on student achievement, and recent experience suggests that ill-advised revisions have the potential to do considerable damage.

To be clear, the CCSS are not perfect, and states that have stuck with them can and should learn from the minor revisions and additions that other states have made. But the need for revisions is not urgent. So in addition to considering the recommendations below, we advise states with solid standards to devote their resources to implementing them well. Replacing the general "all-purpose" professional development that many teachers currently receive with sustained, coherent, and *subject-specific* professional development focused on ELA and math content (and pedagogy) would be a good first step.

## 2 Adopt the improvements that other states have made to support implementation.

In recent years, numerous states have embellished the Common Core with a wide variety of supporting documents and minor additions–in most cases, without attempting a fundamental rewrite. Although the quality of these innovations varies, some of them are well done. In particular, the efforts of California and Massachusetts are worth highlighting.

On the ELA side, Massachusetts has added over 100 grade-specific examples to its grade level content standards, in an effort to make them more concrete. In general, the quality of these examples is high, and their presentation is straightforward and user-friendly. Similarly, California has made some useful additions to its standards for Writing. For example, students are now expected to "write routinely over extended... and shorter time frames" starting in grade 2 rather than grade 3, and the standards for higher grades include more detailed expectations related to thesis statements (grade 6) and dealing with counterarguments (grade 7). Additions to the Speaking and Listening standards also emphasize logic and critical thinking. For example, fifth-grade students are expected to "identify and analyze any logical fallacies" in a speaker's presentation (SL.5.3 CA).

On the math side, Massachusetts has added a description of the Mathematical Practice Standards by grade band that includes specific examples of connections between the content and practice standards (in addition to revising and updating its glossary and bibliography). However, perhaps the most important innovations are at the high school level, where California and Massachusetts have effectively integrated the CCSS-M high school standards (which are presented by conceptual category) with *Appendix A* of the CCSS-M (which provides options for organizing those standards into courses), thus providing a coherent and thorough treatment of high school content and pathways that is ideal for implementation. (The Golden State also includes excellent standards for AP Probability and Statistics and for Calculus courses, while the Commonwealth includes model Precalculus and Advanced Quantitative Reasoning courses.)

## 3 If possible, take the next step by precisely addressing specific limitations of the CCSS-ELA and CCSS-M.

In addition to adopting the improvements identified above, some states should consider taking the next step by addressing some of the other weaknesses our reviewers identify—especially if doing so involves making well-conceived additions, rather than disturbing the delicate internal logic of the existing standards. Specifically, states that feel confident in their ability to manage this process should take the following steps:

### a *Develop disciplinary literacy standards for Speaking and Listening, and for Language, and further develop the disciplinary literacy aspect of the ELA standards for grades 6–12.*

Each discipline (e.g., history, science, mathematics, literature) uses language in particular ways to create, disseminate, and evaluate knowledge. So it's important that students develop an understanding of these differences. As noted in our updated review, however, the Literacy Standards in History/Social Studies, Science, and Technical Subjects (i.e., the Common Core's "disciplinary literacy" standards) could be strengthened, especially in grades 6–12. Most obviously, states could develop specific standards in Speaking and Listening, and in Language, since both of these domains are omitted entirely from the current disciplinary literacy standards.

### b *Define the differences in expectations between 9th and 10th grade and between 11th and 12th grade in ELA.*

At the high school level, the CCSS-ELA standards are divided into two-year grade bands (9–10 and 11–12) "to allow schools, districts, and states flexibility in high school course design." However, reviewers found that this lack of specificity resulted in redundancies across grade levels, making it difficult for teachers to know which standards to cover in which grade, or how the rigor of individual standards ought to increase from one grade to the next. Consequently, states should consider creating grade-specific English language arts standards for high school such that each grade has specific expectations.

**c** *Articulate clear pathways in high school math that are explicitly aligned with specific post-secondary and labor market outcomes.*

Currently, most states list standards for specific high school math courses, but are not clear about how these courses fit together and what they prepare a student to do post-graduation. Ideally, standards would indicate which pathways prepare students for STEM or other quantitative college majors, for the intellectual demands of completing college with a non-STEM major, and for technical and non-technical fields that may not require a four-year degree. Regardless of the path they choose, however, all students should learn algebra, geometry, and statistics and probability —and every student should take four years of high school math.

**d** *Take another look at the alignment between K–12 and pre-K.*

Although a comprehensive review of states' pre-K standards is beyond the scope of this report, both review teams noted that a few states (including Massachusetts) had made a conscious effort to align their pre-K and K–12 standards—something that is clearly desirable in principle. Because it has been more than a decade since most states adopted their pre-K standards, the potential for some sort of misalignment is considerable. Consequently, states that have yet to do so may want to take another look at this issue in consultation with early childhood experts.

***

Our reviewers, as well as those of us at Fordham, believe that the Common Core standards have aged well. Eight years after their publication they still represent a good-faith effort to identify the knowledge and skills that students need to master in order to be on track for success in college and the workplace. Nevertheless, we must remember that standards are only words on paper if they don't inspire great instruction in the classroom. That's where there is clearly more work to be done, as we have learned from various implementation studies, including Fordham's own *Reading and Writing in America's Schools*. Confusion still reigns in too many places. Do the standards expect young students to learn history, science, and other subjects in order to become better readers? (Yes.) Do they require high school English teachers to ditch classic works of literature? (No.) Do they want young children to master their math facts? (Yes.)

The standards, we believe, are clear, and on target, on these and other important points. But something is getting lost in translation. Fixing that problem is as urgent as ever.

# State Reviews

## State Reviews: English Language Arts

*by Diane Barone, Linda Dixon, Douglas Fisher, Nancy Frey, and Tim Shanahan*



## State Reviews: Mathematics

*by Solomon Friedberg, Juliana Belding, Andrew Chen, Francis (Skip) Fennell, and Roger Howe*

English Language Arts

# Common Core State Standards

| | |
|---|---|
| 10 | **Strong** |
| 9 | *Recommend focus on the implementation of these standards.* |
| 8 | **Good** |
| 7 | *Targeted revisions recommended along with a focus on implementation of these standards.* |
| 6 | **Weak** |
| 5 | *Significant revisions recommended. Standards should not be implemented until and unless these revisions are made.* |
| 4 | **Inadequate** |
| 3 | |
| 2 | *Complete revision highly recommended. Standards have critical shortcomings and should not be implemented.* |
| 1 | |

## Overall Rating: Strong (9/10)

Content & Rigor (6/7) + Clarity & Specificity (3/3)

## Overview

The Common Core State Standards for English Language Arts, and Literacy in History/Social Studies, Science, and Technical Subjects are well focused, coherent, and rigorous. Major strengths include clear definitions and expectations relative to teaching students to read complex texts, including useful examples of what constitutes appropriate texts; inclusion of disciplinary literacy standards in grades 6–12 (that designate the specialized literacy skills in areas such as history, social studies, science, and technical subjects); and "learning progressions" embodied in College- and Career-Readiness standards (CCR) that describe what students should be able to do in reading, writing, listening, and speaking by the time they graduate high school.

In addition, the emphasis on Foundational Skills in elementary reading (e.g., basic print concepts, phonological awareness, phonics, fluency) underscores the importance of these skills to early reading development, while also communicating the value of comprehension and academic vocabulary development. Unfortunately, these progressions are occasionally undermined by vague or inconsistent terminology, abrupt transitions between grade levels, and a focus on skills over key content to be taught. The omission of Speaking and Listening and Language standards in grades 6–12 for subjects other than English language arts is problematic. Despite these minor weaknesses, the Common Core State Standards provide a rigorous and coherent pathway for preparing students to be ready for post-secondary opportunities.

# General Organization

The Common Core State Standards for English Language Arts, and Literacy in History/Social Studies, Science, and Technical Subjects (herein referred to as CCSS-ELA) are organized into three distinct sections:

1. Grades K–5 ELA;
2. Grades 6–12 ELA; and
3. Literacy in History/Social Studies, Science, and Technical Subjects, grades 6–12.

The first two sets of standards (grades K–5 and 6–12 ELA) are organized into four domains: Reading; Writing; Speaking and Listening; and Language. The standards for Literacy in History/Social Studies, Science, and Technical Subjects are divided into two domains: Reading and Writing. (The Speaking and Listening and Language domains are not specified in this section of the document.)

The CCSS-ELA are articulated horizontally and vertically across the grade levels. More specifically, each grade-specific standard can be associated with all of the other grade-specific standards in the same strand such that a reader can see in a simple table how a reading standard progresses from kindergarten through twelfth grade. Each standard is also associated with a College- and Career-Readiness standard (CCR). For instance, a fourth-grade reading standard such as "Refer to details and examples in a text when explaining what the text says explicitly and when drawing inferences from the text" (RL.4.1), is linked to the CCR standard that specifies, "Read closely to determine what the text says explicitly and to make logical inferences from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text" (CCRA.R.1). Such linkages provide a clear idea of how learning expectations evolve and deepen from K–12.

Individual grade-level standards are defined for grades K–8. In high school, the grade-level standards are reported in two-year bands "to allow schools, districts, and states flexibility in high school course design" (grades 9–10 and 11–12).

The standards are also accompanied by three appendices: a resource with information on text complexity, early reading foundations, and text types; a list of "exemplar" literary and informational texts and performance tasks by grade span; and annotated student writing samples that demonstrate writing expectations.

# Content & Rigor

## + Content & Rigor Strengths

The CCSS-ELA have several notable content strengths. First, the standards make clear that college- and career-readiness is a fundamental goal of education. The broad CCR standards link effectively to grade-specific standards and remind educators to keep the end goal in mind, regardless of students' age. For instance, one CCR Anchor Standard for Reading requires students to "read closely to determine what the text says explicitly and to make logical inferences from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text" (CCRA.R.1). The standards carefully build from grade to grade to assure that the desired outcome is reached by the end of high school. Standards that lack this focus may unintentionally lull educators into attending primarily to a specific grade level, with less regard for what students should have mastered along the way, and what they need to learn to progress to the next grade level and beyond.

Second, the CCSS-ELA notably include disciplinary literacy standards for science, history/social studies, and technical subjects in grades 6–12. These standards illuminate the role of literacy in knowledge construction and articulate the nature of reading and writing that is unique to each of the several disciplines. For instance, in the Reading Standards for Informational Text in K–5, fifth-grade students are expected to "draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently" (RI.5.7). This expectation reveals the close connection between literacy and knowledge development.

The grades 6–12 ELA standards do a fine job of covering this same ground for the reading of literature and general informational text. For instance, RST.11-12.8 reads, "Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information." This standard is relevant to a particular type of reading in a specific discipline. Notice how it is distinguished from a corollary History standard: "Evaluate authors' differing points of view on the same historical event or issue by assessing the authors' claims, reasoning, and evidence" (RH.11-12.6), and an English standard, "Determine an author's point of view or purpose in a text in which the rhetoric is particularly effective, analyzing how style and

content contribute to the power, persuasiveness or beauty of the text" (RI 11-12.6). While the Literacy Standards in History/Social Studies, Science, and Technical Subjects could be strengthened (see below), they succeed in showcasing disciplinary literacy as an essential element of secondary education.

Third, the CCSS-ELA establish clear guidelines regarding the level of text complexity that students are expected to be able to read. Text complexity is described in Reading Standard 10, which requires that students "read and comprehend complex literary and informational texts." These general statements are further delineated in the standards by quantitative (not qualitative) expectations of reading performance across the grades (such as word frequency and sentence length). *Appendix A* of the CCSS-ELA also identifies new research on quantitative and qualitative measures of text complexity (such as text structure and knowledge demands) and concludes with a set of recommendations for educators to support appropriate text selection and a list of exemplar texts representative of these complexity requirements. This list of exemplars is meant to be illustrative rather than complete; it presents examples of items that could be included in a curriculum rather than a curriculum itself.

Finally, the CCSS-ELA writing standards are thoughtfully organized into four major categories:

1. Text Types and Purposes;
2. Production and Distribution;
3. Research to Build and Present Knowledge; and
4. Range of Writing.

In general, these standards emphasize writing production and outcomes, as opposed to processes. For example, one eighth-grade literacy standard requires that students, "provide a conclusion that follows from and reflects on the narrated experiences or events" (W.8.3e). Although writing is often perceived as an independent task, the standards also include consistent language about the collaborative nature of the process, calling for "guidance and support from peers and adults" (e.g., W.5.6), and requiring students to "interact and collaborate with others" (e.g., W.4.6). These expectations connect seamlessly to the standards for the Speaking and Listening domain, which call for students to engage in a range of collaborative discussions (one-on-one, in groups, and teacher-led) for the purpose of discussing grade-appropriate topics, texts, and tasks.

## – Content & Rigor Weaknesses

While there are many strengths relative to the content of the CCSS-ELA, several areas could be improved.

First, the standards lack grade-specific English language arts standards for high school. While intended to provide flexibility, this lack of specificity for each high school grade level results in redundancy in standards for the two grade bands. For instance, reading and writing standards are identical for ninth and tenth graders; consequently, teachers and others cannot see how rigor should advance from grade to grade within high school.

There are also some issues in the learning progressions. The CCR standards serve to anchor the standards across the grade levels; however, some internal inconsistencies may obscure the intent of the standards. For example, a standard for reading literature in kindergarten is to "recognize common types of texts" (RL.K.5), yet the corresponding standard for reading informational text is to "identify the front cover, back cover, and title page of a book" (RI.K.5). These are two highly disparate skills, yet they are placed in parallel and linked to the same CCR standard.

Another significant gap in the *Literacy in the History/Social Studies, Science, and Technical Subjects* section is that the Speaking and Listening and Language domains are omitted altogether. This omission suggests a lack of importance of oral language in the acquisition and consolidation of disciplinary knowledge. Yet, collaborative discussion about abstract concepts is crucial for schema building and deepening of knowledge. Similarly, the need for mastery of academic vocabulary and language is integral to every subject and discipline, though the nature of vocabulary in the different disciplines differ in important ways (such as the use of metaphorical terms like the *Gilded Age* in history or the use of Greek or Latin combining forms in science).

Finally, the text complexity progressions are a bit uneven and overly rigorous, seemingly requiring faster progress in the early elementary grades (e.g., 2, 3, 4) than in the later grades. For example, in Foundational Skills, kindergartners are expected to apply grade-level phonics and word analysis skills when decoding words and associate short and long vowel sounds with common spellings, a rigorous expectation for kindergartners. Similar issues are evident in the writing standards. The articulation of the writing standards, for example, reveals that argumentative writing requires years to master and must be practiced through twelfth grade. But the initial step to writing for argumentation in grade 6

is overly ambitious (e.g., students are expected to write an argument with supportive claims and evidence using credible sources, use words to clarify relationships among the claims, use a formal style, and provide a concluding statement), and the wording of the standard fails to adequately account for the progressive nature of young adolescents' writing.

The learning progressions in grades 7 and 8 are similarly worded, where students are expected to learn how to build counterarguments/counterclaims and foster internal cohesion in the text. While the call for writing for argumentation beginning in middle school is laudable, it is ambitious to expect that all students will learn what is required regarding claims, reasoning, and evidence.

# Clarity & Specificity

## + Clarity & Specificity Strengths

Overall, the CCSS-ELA are admirably clear, specific, and well organized. They focus on presenting high-quality standards without the distraction of superfluous items. The organization of the standards makes them comprehensible both within and across grades, and the overviews at the beginning of each section offer clarity about the standards that follow. As indicated, the CCR standards helpfully focus attention on the desired outcomes of a K–12 education and provide a grade-by-grade roadmap for getting there. By and large, the standards document is free of jargon, and can be understood by educators, curriculum developers, and textbook writers alike. The majority of standards are measurable, with only rare exceptions (e.g., K.RL.5, which states that students "recognize" types of text, without further elaboration).

Additionally, several supporting documents buttress the standards and aid in interpretation, including the three appendices and documents that explain or provide exemplars for various standards. The document is also greatly enhanced by the introduction that contextualizes the standards themselves. These include an introductory section explaining the history of the standards, detailed information on key design details, a page on what the standards *are not* (e.g., they are not specifications of how to teach; they are not all that students should learn, and so on) and directions on how to read the document. This section also includes a helpful table illustrating language progressions, text complexity, text exemplars, and a sample knowledge progression in K–5.

## – Clarity & Specificity Weaknesses

Although the CCSS-ELA are coherent, clear, and well organized, there are occasional uses of vague or unnecessary terminology that interrupts the flow of the learning progressions. In grade 2, for instance, writers use "digital tools to produce and publish" (W.2.6), but in grade 3 they "use technology" to do the same thing. In grade 5, students "develop the topic with facts" (W.5.2b), but in grade 6 students are expected to use "relevant facts" (W.6.2b). Sixth-grade writers are encouraged to use "credible sources" (W.6.1b), but in grade 7 these are now "accurate, credible sources" (W.7.1b). It is unclear how quoting "accurately from a text when explaining what the text says explicitly" in grade 5 (RL.5.1) is different from citing "textual evidence to support analysis of what the text says explicitly" in grade 6 (RL.6.1).

In addition, transitions between major grade-level bands, especially between grades 2 and 3 and grades 5 and 6, are sometimes precipitous or abrupt. For example, second-grade writers are advised to use linking words such as *because, and, also* (W.2.1), but in third grade the examples include *therefore*, an unlikely word for young children to use, let alone incorporate in their writing. Similarly, the jump from writing opinion with evidence (in grade 5) to writing for argumentation as a genre (in grade 6) is steep and disjointed. These standards do not properly scaffold necessary skills to accomplish these outcomes

# Recommendations

1. Revise the Literacy in History/Social Studies, Science, and Technical Subjects to include specific standards in Speaking and Listening and in Language, and further develop the disciplinary literacy aspect of the standards for grades 6–12.
2. Improve transitions between grade bands, especially the transition between grades 2 and 3 and between grades 5 and 6, to determine whether the expectations are appropriately paced. Particular attention should be paid to the pacing of initial expectations for argumentation in writing in grade 6 and text complexity from grades 2 to 4.
3. Create grade-specific English language arts standards for high school to clarify expectations at each grade level and eliminate duplication across grades.

4. Examine the learning progressions across the grade levels to ensure that language is consistent and precise.
5. Review the wording of individual standards to reduce vague, inconsistent, or extraneous language that obscures the intent.

### Bottom Line

Recommend focus on the implementation of these standards.

## Documents Reviewed

- Common Core State Standards for English Language Arts, and Literacy in History/Social Studies, Science, and Technical Subjects, accessed from http://www.corestandards.org/ELA-Literacy/.
- *Appendix A*. Research Supporting Key Elements of the Standards and Glossary of Key Terms: http://www.corestandards.org/assets/Appendix_A.pdf and *Appendix B*, accessed from www.corestandards.org/assets/Appendix_B.pdf.

English Language Arts

# Arizona

10 9 — **Strong**

*Recommend focus on the implementation of these standards.*

8 7 — **Good**

*Targeted revisions recommended along with a focus on implementation of these standards.*

6 5 — **Weak**

***Significant revisions recommended. Standards should not be implemented until and unless these revisions are made.***

4 3 2 1 — **Inadequate**

*Complete revision highly recommended. Standards have critical shortcomings and should not be implemented.*

## Overall Rating: Weak (6/10)

Content & Rigor (4/7) + Clarity & Specificity (2/3)

## Overview

The Arizona English Language Arts Standards were adopted in 2016, and implementation is scheduled for the 2018–19 school year. Overall, the standards are well written, concise, and well organized. Major strengths include strong Early Childhood Literacy and Foundational Standards in Reading and Writing for grades K–5 that advance early childhood education. The standards also emphasize students' vocabulary acquisition by embedding vocabulary and language standards into reading and writing standards and aligning them internally with learning progressions across the grades.

However, several weaknesses undermine the content and rigor of the standards. Although text complexity measures are required (more below), there are no guidelines or expectations for what constitutes grade-level appropriate texts. Nor are there any recommended reading lists, text exemplars, or performance task suggestions, which likely means that text complexity will be interpreted differently by individual educators—raising issues of equity across classrooms, grade levels, schools, and districts.

Equally troubling is the absence of any disciplinary literacy standards in History, Science, or Technical Subjects for grades 6–12, meaning educators in these areas are presumably expected to know how to integrate into their subjects, without any guidance, the standards for English Language Arts Reading Informational Text, Writing, and Speaking and Listening.[1] This omission risks leaving students ill-prepared for the reading and knowledge demands of post-secondary education and the workforce.

# General Organization

The Arizona English Language Arts Standards are presented by grade level in grades K–8, and as grade bands in 9–10 and 11–12. Each grade level's standards are preceded by a one-page overview that summarizes the expectations for the grade. Grade-level standards are separated into several strands or domains: Reading Literature and Informational Texts (key ideas and details, craft and structure, integration of knowledge and ideas, range of reading and text complexity); Writing (text types and purposes, production, distribution, research); Speaking and Listening, (comprehension, collaboration, and presentation); and Language standards (conventions and knowledge).

In addition, separate strands for Foundational Reading and Writing Skills are included for grades K–5, with standards for letter recognition, print and phonological awareness, high frequency words, phonics, fluency, printing, spelling, handwriting, and cursive. The standards are accompanied by several supplemental resources, including a glossary of key terms and concepts and a "vertical articulation" document that lays out the developmental progression for each standard in grades K–12.

# Content & Rigor

## + Content & Rigor Strengths

One notable strength of Arizona's ELA standards is its approach to foundational skills. Early literacy is the basis upon which more complex reading and writing skills are built and the Foundational Reading skills strand is strong, generally focusing on the skills identified by research as being essential to reading development (such as print concepts, phonological awareness, phonics and word recognition, fluency, and so on). Likewise, the Writing Foundational Skills strand for grades K–5 aims to ensure that students have the basic writing skills that enable composition, in part by applying grade-level phonics skills when decoding words. The standards also call for specific progressions by grade, starting with letter-sound correspondence in grades K–1 (K.WF.3, 1.WF.3), through morphology (how words are formed) in grades 4–5 (4.RF.3, 5.RF.3). Word analysis skills are used to build fluency (e.g., sight word progressions are recommended, although the choice of specific word lists are left to individual educators). The standards also include expectations for developmental progression in printing and cursive.

Another strength is the importance placed on vocabulary acquisition. Throughout the standards, vocabulary knowledge is inextricably linked to reading comprehension. Arizona's standards address vocabulary across multiple strands, signaling its value by including expectations in both Reading Informational (RI) and Literary Standards (RL), as well as the Language Strand. The former (RI and RL) both require students to "interpret words and phrases as they are used in a text, including determining technical, connotative, and figurative meanings, and analyze how specific word choices shape meaning or tone" (R.4). Language Anchor Standard 4 states, "Determine or clarify the meaning of unknown and multiple meaning words and phrases by using context clues, analyzing meaningful word parts, and consulting general and specific reference materials, as appropriate." The standards also require that students interact in multiple ways with text to comprehend and build knowledge; in doing so, they acquire a steadily increasing vocabulary with an emphasis on academic and domain specific words.[2]

Third, the standards require students to find and use evidence from texts to support their findings, inferences, opinions, and arguments. This key skill is developed in Reading Informational Text and Reading Literature Standard 1—which advances in fourth grade from requiring students to "refer to details and examples" when drawing inferences from text (4.RL.1, R.RI.1), to expecting eighth-grade students to cite evidence that "most strongly supports" inferences drawn from text (8.RL.1), and continuing in complexity through grades 11–12. The writing standards similarly emphasize using reliable, text-based sources to develop a written idea. For example, Anchor standards 1, 8, and 9 require students to support claims in text and topic analysis with valid reasoning and sufficient evidence when writing arguments; gather information from multiple print and digital sources, assessing reliability and credibility of information; and draw evidence from literary or informational texts to support analysis, reflection, and research.

## − Content & Rigor Weaknesses

Five key weaknesses undermine the Arizona standards. First, some expectations are overly idealistic, especially in the early grades. For example, kindergartners are required to learn to read twenty high frequency words, which increases

exponentially to one hundred in the first grade, two hundred in the second grade, and five hundred by the third grade, with the only guidance being that high-frequency words need to include irregular spelling and word patterns. Five- and six-year-olds are also asked to demonstrate phonological awareness by "orally generate a series of rhyming words using a variety of phonograms (e.g., -ed, -ake, -ant, -ain) and consonant blends (e.g, /bl/, /st/, /tr/)" (1.RF.2.e) and "demonstrate understanding of spoken words, syllables, and sounds (phonemes)" (1.RF.2)—an incredible feat considering that rhyming words typically use ending and not beginning blends. First graders must also "recognize and apply all six syllable types when decoding grade-level text" (1.RF.3.d).

Second, the standards pose no requirements that students be familiar with or knowledgeable about any specific works of literature, authors, or historical documents (though the glossary does provide a list of broad genres—poetry, autobiographies, historical texts, and so on—that students in grades 6–12 should be exposed to). Content knowledge impacts reading comprehension. Therefore, standards should require that students build knowledge from texts, including content-rich nonfiction in grades K–12. Moreover, without such commonality, issues of equity and rigor among classes, grades, schools, and districts inevitably arise.

Third and related, the standards lack clear guidance on how to measure and increase text complexity so that it is grade-level appropriate. While the glossary explains the importance of using quantitative, qualitative, and reader and task demands when choosing texts, no specifics are provided.[3] Further, unlike the CCSS-ELA appendices, Arizona does not suggest reading levels for each grade band. With most college and many workforce-relevant texts having Lexile levels up to 1800, Arizona would do well to implement grade-level targets to ensure requisite proficiency. While standards writers indicate that these omissions were intentional so as to leave curricular choices to local educators, they are nonetheless problematic, and raise questions around equity and access, as what is considered "grade-level text" in one school or district may be vastly different from those read and discussed in another.

Fourth, the standards fail to articulate grade-specific expectations in high school. For example, there is no differentiation between grades for standards such as 11–12.RL.3, which requires eleventh and twelfth graders alike to "analyze the impact of the author's choices regarding how to develop and connect elements of a story or drama." Standards should increase in rigor in progressive grades, not muddy expectations across grades.

A final critical weakness is omission of disciplinary literacy standards, or standards focused on applying advanced reading and writing aptitude to subject-specific learning. To render a sophisticated reading of texts specific to certain disciplines (e.g., mathematics, science, history, literature), students need to develop an awareness of the unique purposes and text features relevant to each of those areas. Similarly, the standards lack any mention of discipline-specific writing. Since most texts encountered in the post-secondary realm will be discipline-specific, these are significant weaknesses.

## Clarity & Specificity

### + Clarity & Specificity Strengths

The Arizona standards are largely free of jargon and are well organized for each grade level. As indicated, the standards include a vertical progression document that shows the development of expectations across grades K–12. Other resources include a helpful glossary that defines, among other things, the six types of syllables, the difference between the three tiers of vocabulary, and the triangular method of measuring text complexity, as well as an introduction that explains how the standards are organized.

### – Clarity & Specificity Weaknesses

In places, the standards are frustratingly vague or lack critical content. For example, while they encourage exposing students to a balance of literary and informational texts, they are silent on what that balance should look like. The standards also lack text exemplars for reading and anchor papers that demonstrate the accomplishment of particular writing goals.

In addition, as previously noted, combining high school standards into grade level bands (grades 9–10 and 11–12) makes it difficult for teachers to know what is expected during particular high school years, to teach appropriately rigorous content, and to avoid duplication of content across grades.

# Recommendations

1. Designate specific and consistent expectations for choosing complex texts by grade level, encompassing the full triumvirate of text complexity guidelines (qualitative, quantitative, and reader and task demands).
2. Develop discipline-specific literacy standards for grades 6–12 to communicate expectations for use outside of the English classroom.
3. Designate specific literary and informational texts at all grade levels with which students should be familiar (or at minimum, provide exemplar texts for teacher consideration).
4. Include expectations for genres/subgenres and literary elements that should be mastered in the literature standards.
5. Ensure grade-level expectations are appropriate and not overly rigorous, especially in the early grades.
6. Create grade-specific English language arts standards for high school to clarify expectations at each grade level and eliminate duplication across grades.

## Bottom Line

Significant revisions recommended. Standards should not be implemented until and unless these revisions are made.

## Documents Reviewed

- Arizona English Language Arts Standards (Adopted December 2016), accessed from https://www.azed.gov/standards-practices/k-12standards/english-language-arts-standards/.
- Introduction, accessed from https://cms.azed.gov/home/GetDocumentFile?id=585aa764aadebe12481b842a.
- Glossary, accessed from https://cms.azed.gov/home/GetDocumentFile?id=585aab93aadebe12481b845e.
- Anchor Standards, accessed from https://cms.azed.gov/home/GetDocumentFile?id=585aa703aadebe12481b8424.

## Endnotes

1. While Achieve's Strong Standards report notes that Arizona "is in the process of developing disciplinary literacy standards," the state was not able to corroborate that information when contacted in early 2018. See: https://www.achieve.org/files/StrongStandards.pdf.
2. The glossary also provides definitions and examples of Tier 1, 2, and 3 vocabulary words.
3. Arizona offers only this broad guidance: "Choosing a valid text analyzer tool from second grade through high school will provide a scale by which to rate text complexity over a student's career, culminating in levels that match college and career readiness."

English Language Arts

# Indiana

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**Strong**

*Recommend focus on the implementation of these standards.*

**Good**

***Targeted revisions recommended along with a focus on implementation of these standards.***

**Weak**

*Significant revisions recommended. Standards should not be implemented until and unless these revisions are made.*

**Inadequate**

*Complete revision highly recommended. Standards have critical shortcomings and should not be implemented.*

## Overall Rating: Good (8/10)

Content & Rigor (6/7) + Clarity & Specificity (2/3)

## Overview

The content and rigor of the English/Language Arts (ELA) Standards for Indiana Public Schools are thorough and well-articulated. Overall, the standards are coherent, easy to follow, and free of jargon, making them understandable to the general public. They explicitly distinguish standards from curriculum and instructional practices. The documents are well organized, presenting all of the ELA standards for each grade level and tracing the progression of standards across grade levels. Notably, the standards for foundational literacy skills in reading and writing (e.g., print awareness, letters, phonological awareness, phonics, fluency, handwriting) are well articulated and consistent with current research. The documents also commendably include standards for reading and writing in disciplinary subjects, and are accompanied by an ancillary resource on text complexity, which is central to the standards focused on reading comprehension.

As for weaknesses, while the standards indicate the importance of analyzing works of "literary or cultural significance," they fail to specify any specific literary or public documents that students should read. They also lack content area requirements for listening and speaking, and occasionally lack specificity (e.g., genres and subgenres). Grade-specific standards are not articulated for high school, resulting in redundancy in expectations across grade spans. Finally, as noted above, specifications for determining text complexity are not included or directly referenced within the standards; educators have to search for these on the website under Educator Resources, though this guidance is critical for teachers to understand text complexity requirements. Despite these weaknesses, students who meet the Indiana English standards will be reasonably well-prepared for college or career.

# General Organization

Indiana's standards are presented in several separate documents: two vertical articulation documents (for K–grade 5 and grades 6–12) that show how each standard develops from grade to grade; and grade level documents (one each for grades 1–8, and one each for grade bands 9–10 and 11–12). The former begins with a thorough introduction that provides the legislative history of the standards, a detailed description of the standards development process, and a section distinguishing standards from curriculum and instruction.

The standards are organized into seven categories: Reading Foundations (grades K–5), Reading Literature, Reading Nonfiction, Vocabulary, Speaking and Listening, Research, and Media Literacy. Standards are also included for Content Area Literacy in History/Social Studies and Science/Technical Subjects for grades 6–12. Support documents include a glossary; a correlation guide comparing these standards with the previous two versions of Indiana Education Standards; K–5 online support tools; standards for Journalism, Mass Media, and Student Publications; and various online resources for parents and educators, including a document on how to measure text complexity.

# Content & Rigor

## + Content & Rigor Strengths

The Indiana English Standards have several notable content strengths. First, they emphasize Reading Foundations in grades K–5 in the areas of print concepts, letters, phonological awareness, phonics, and fluency. Appropriately, some of these areas are only addressed through grade 1, while others are emphasized across the elementary grades. The Reading Foundations skills that are required are consistent with those that research deems essential.

Similarly, the Reading Literature and Reading Nonfiction standards are comprehensive without the distraction of superfluous or unnecessary content. For example, reading comprehension of literature and informational text (or "nonfiction text;" these terms are used interchangeably in the Indiana standards) is addressed from kindergarten through grade 12. The standards explicitly state that students should be able to identify key ideas and details, draw appropriate inferences, and make use of text structure with grade-level appropriate texts (and grade-appropriateness of text is specified explicitly and thoroughly). They require that students be able to do these things with single texts, and also to integrate and synthesize information across multiple texts. This multiple-text requirement is stressed both in the reading portion of the standards and in the research standards. The standards also include disciplinary literacy standards for grades 6–12 that specify the special comprehension requirements needed to read history, social studies, science, and technical materials in appropriate and sophisticated ways.

The writing standards are also strong and emphasize academic writing or public writing such as writing essays or arguments, rather than personal writing such as diaries or journals. The standards include handwriting, quality features of effective writing, the writing process (e.g., planning, drafting, revising), and the importance of being able to produce various genres of writing (e.g., informational, persuasive, narrative), and to conduct research. Similarly, the Speaking and Listening standards emphasize using language to comprehend, discuss, and present information in ways that will adequately prepare students for success in college or career. Research skills are emphasized across grades K–12 and build in difficulty across grades (for example, requiring students to formulate research questions, gather relevant information from multiple sources, and assess the credibility and accuracy of each source in grade 6 and beyond).

The Indiana English standards also include separate sections or strands focused on vocabulary, conventions of standard English in written and oral language, and media literacy. Separating out vocabulary in this way is notable, as vocabulary is often subsumed within the reading or oral language standards. Given the importance of vocabulary in academic achievement, this highlighting is likely to encourage teachers to pay greater attention to its development, including teaching word meanings, combining forms, use of context, and use of reference resources.

A final major strength of the standards is their coherence across the grades. Each standard is carried across the grade levels so that readers can trace the development of particular skills and have a richer and more complete understanding than the individual grade level standards can provide. For example, K.RN.2.2 requires kindergarten students to "With support, retell the main idea and key details of a text." In first grade, students are expected to retell the main ideas and key details without support, and by

second grade, they are expected to "Identify the main idea of a multiparagraph text and the topic of each paragraph" (2.RN.2.2). The standards appear to be arrayed in appropriate developmental sequences and are properly matched to the grade levels at which students are expected to accomplish them.

### − Content & Rigor Weaknesses

One unfortunate omission is the lack of attention to reading rate or speed in fluency. Indiana's standards emphasize accuracy and expression but neglect the importance of how quickly students should be able to read text. Fluency has been found to enable reading comprehension, but to do so students must read texts accurately, with appropriate speed and expression (in other words, students need to learn to read text so that it sounds like language). Without violating these standards, it is possible for students to read words accurately but slowly and laboriously—reading behaviors that undermine comprehension.

The standards fail to provide examples of appropriate texts or require particular texts, exacerbating the lack of clarity in specifying the challenge-levels of the text reading requirements. Reading comprehension goals are meaningless unless interpreted within the demands of specific texts or text levels.

Finally, the standards lack grade-specific English language arts standards for high school. This approach results in redundancy in standards across grade spans, and makes it unclear how expectations and rigor are to advance from grade to grade.

## Clarity & Specificity

### + Clarity & Specificity Strengths

Overall, the standards are clearly written and jargon-free; both educators and the public are likely to understand them. The majority of the standards appear to be measurable, an essential element for formative and summative assessment of pupil progress toward goals. For example, Indiana's genre writing standards focus on the quality of the texts that students are to produce. For example, seventh-grade students are expected to "write arguments in a variety of forms that introduce claim(s), acknowledge alternate or opposing claims, and use appropriate organizational structures" (7.W.3.1). The standards are also specific in nature and do not contain unnecessary verbiage. They are presented in multiple formats (e.g., grade-by-grade, cross-grade progressions, correlations with past standards) along with a reasonably thorough glossary and various online supports for teachers and parents.

### − Clarity & Specificity Weaknesses

Although the standards do an admirable job of explaining the concept of complex text and what constitutes text complexity for particular grade levels, this information is included in a separate document that is not housed with the other standards documents on the website, or explicitly referred to in the standards themselves.

In places, Indiana's standards conflate writing and research processes with writing production. For example, see the following sixth-grade standard, which is repeated in multiple grades:

> *Write routinely over a variety of time frames for a range of tasks, purposes, and audiences; apply reading standards to support analysis, reflection, and research by drawing evidence from literature and nonfiction texts (6.W.1).*

This standard combines an instructional activity that good teachers might use to teach students to write well ("write routinely…") with a measurable outcome that students are to try to reach ("draw evidence from literary or informational texts"). And the first part of the standard says nothing about the volume or length of writing. Such standards fail to specify learning outcomes (things that students should know or be able to do) and cannot be easily measured.

Additionally, the standards treat literary genres and subgenres generally, indicating that students should learn to read "literature in different forms and genres (e.g., stories and poems, historical novels and fantasy stories)," but offering no specifics as to which genres and subgenres the students must master or what specific literary elements of these they are expected to understand (6.RL.4.2). The general statements make clear that such learning is to be accomplished, but the document lacks sufficient specificity to ensure its accomplishment.

Finally, the Indiana standards ambiguously state that:

- *The standards do not necessarily address students who are far below or far above grade-level.*
- *The standards are designed to show what the average Hoosier student should know and be able to do in order to be prepared for college and career. However, some students may be far below grade level or in need of special education, and other students may be far above grade level. The Standards do not provide differentiation or intervention methods necessary to support and meet the needs of these students. It is up to the district, school, and educators to determine the best and most effective mechanisms of standards delivery for these students.*

It is not clear whether the intention of this is to exempt particular students from meeting the standards or whether it is simply acknowledging that local districts are responsible for making the adjustments necessary to help such students meet the standards.

## Recommendations

1. Create grade-specific English language arts standards for high school to clarify expectations at each grade level and eliminate duplication across grades.
2. Add explicit references or links to the text complexity specifications to the grade level reading standards.
3. Adopt fluency rate norms for each grade level to ensure that students become fluent enough to comprehend texts well.
4. Revise writing standards to translate research and writing process standards into requirements that can be taught and measured. Clarify vaguely written standards and those that conflate processes with outcomes.
5. Designate specific literary and informational texts at all grade levels with which students should be familiar (or at minimum, provide exemplar texts for teacher consideration).
6. Include expectations for genres/subgenres and literary elements that should be mastered in the literature standards.

### Bottom Line

Targeted revisions recommended along with a focus on implementation of these standards.

## Documents Reviewed

- Indiana English/Language Arts Standards (September 2017), Indiana Content Area Literacy Standards, and ELA Standards Correlation Guides, accessed from https://www.doe.in.gov/standards/englishlanguage-arts#Standards
- Guide to Text Complexity, accessed from http://learningconnection.doe.in.gov/

English Language Arts

# Kansas

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**Strong**

*Recommend focus on the implementation of these standards.*

**Good**

***Targeted revisions recommended along with a focus on implementation of these standards.***

**Weak**

*Significant revisions recommended. Standards should not be implemented until and unless these revisions are made.*

**Inadequate**

*Complete revision highly recommended. Standards have critical shortcomings and should not be implemented.*

## Overall Rating: Good (7/10)

Content & Rigor (6/7) + Clarity & Specificity (1/3)

## Overview

The Kansas K–12 Standards for English language arts were approved by the State Board of Education in November 2017. The standards are generally well organized and have several notable content strengths. These include an adept integration of language into the elementary standards, and reading standards that set clear text complexity expectations that consider qualitative as well as quantitative properties. This latter is an important strength, as it signals clear expectations for Kansas students.

However, omissions in language at grades 6–12, and a lack of examples or exemplars of seminal texts with which students should be familiar undermine otherwise promising standards. Also notably absent are standards for disciplinary literacy in science, history/social studies, and technical subjects in grades 6–12. The standards also lack grade-specific high school standards and key supporting documents necessary to guide and inform implementation this fall.[1]

## General Organization

Kansas's ELA standards are organized into the following five domains: Writing; Speaking and Listening; Reading: Foundational (K–5); Reading: Literature; and Reading: Informational. A previously distinct Language domain has been absorbed into the other domains and now appears as strands within these major domains: Language in Writing, Language in Speaking and Listening, Language in Reading: Literature, and Language in Reading: Informational. Standards are presented for individual grades through eighth grade, after which they appear in two grade bands: 9–10 and 11–12.

At nearly 600 pages, the document is bulky and cumbersome. However, it is hyperlinked throughout, which helps improve navigation among the pages.

Each standard is followed by suggestions and implementation guidance in three categories:

1. *Curriculum/Instruction*: "To address this standard, students could..."
2. *College- and Career-Readiness*: "Kansas high school graduates can..." followed by a statement of intention of the standard.
3. *Learning Progression*: The target grade level standard appears alongside the one immediately preceding and following it.

# Content & Rigor

## + Content & Rigor Strengths

The 2017 standards have several notable content strengths. The reading standards (RI.13 and RL.13) include helpful language about qualitative as well as quantitative text complexity. They make further reference to the "text complexity triangle," which includes reader and task analysis. Although text complexity expectations are not specifically defined in the document, there are extensive materials regarding text complexity measures available elsewhere on the Kansas State Department of Education website. However, these resources would be more helpful if they were linked directly from the standards document.

Second, the Language standards have been subsumed into the Writing, Speaking and Listening, and Reading domains to good effect in the elementary grades. The positioning of grammar, syntax, and conventions within the expressive domains of Writing and Speaking and Listening makes sense. For example, kindergarten students "demonstrate command of the conventions of standard English capitalization, punctuation, and spelling when writing" (W.K.11), thus tying mastery of conventions directly to writing, rather than assigning it to a separate Language domain where it might otherwise be overlooked. Likewise, the standards that highlight vocabulary development and the use of formal and dialectal conventions when reading are appropriately linked in this domain. For example, fifth graders are expected to "acquire and use accurately grade-appropriate general academic and domain-specific words and phrases, including those that signal contrast, addition, and other logical relationships" when speaking (SL.5.8). In this way, vocabulary is understood as a function of speaking as well as reading and writing.

A third area of strength is the clear positioning of argumentation and reasoning in middle and high school. Argumentation as a text type is explicitly named in the writing standards (e.g., W.6.1 requires students to "write arguments to support claims with clear reasons and relevant evidence" and is followed by five elements that further explain the use of claims and reasoning). Importantly, this same vein of argumentation carries through to other standards. For example, sixth-grade students "assess the credibility of the sources they use" in Research to Build and Present Knowledge (W.6.8) and in Speaking and Listening as they "sequence ideas logically" (SL.6.4). This intertwined approach contributes to the coherence of the standards across the ELA domains.

## − Content & Rigor Weaknesses

A major omission is specification by name of any seminal texts or authors that all Kansas students should know and be familiar with (e.g., specific works by Shakespeare, the Constitution, the Declaration of Independence, and other foundational U.S. documents). The standards also lack examples and text exemplars, which illuminate the range and type of reading materials students should encounter. This ambiguity may make it difficult for teachers to choose grade-level-appropriate texts, as it leaves such decisions open to broad interpretation. Similarly, scant attention is paid to genres and subgenres. While some are included (e.g., poetry, traditional stories, folktales, mythology), others are missing entirely (e.g., epic poems, speeches, satires and parodies, essays, literary criticism, reviews). Taken together, the standards' lack of specificity using examples, exemplars, and genres fails to ensure that all students will be challenged with appropriately rigorous texts.

Disciplinary literacy, the application of advanced reading and writing for subject-specific learning, is a second major omission. While Kansas students are expected to write "for discipline-specific tasks" and to "maintain the norms and conventions of the discipline," no other guidance or expectations are provided. Disciplinary literacy standards for science, history, and technical subjects emphasize the importance of integrating quantitative information within technical writing, specify the critical analysis of artifacts within a historical context, and require the use of discipline-specific reasoning. The absence of these specifications reduces the likelihood that secondary students will master the literacy skills needed for knowledge acquisition in these fields.

The high school grade-level expectations are also problematic. These are reported in two-year bands (9–10 and 11–12), rather than at the individual grade level, as is the case for grades K–8. Literacy is a tool for gaining knowledge and expressing ideas, and the increased content demands for adolescents should mean that the language arts receive more attention, not less. Yet when standards do not change for two years at a time, it's unclear how expectations and rigor are to advance from grade to grade.

Finally, no mention is made of citation methods using a specific format (e.g., Modern Language Association or Chicago style), although there is reference to a "standard format for citation." This is a major skill that should be developed in high school English classes and not left to chance, as college students are expected to know how to correctly cite sources of research using a style manual.

# Clarity & Specificity

## + Clarity & Specificity Strengths

The standards are generally well organized and largely free of jargon. Grade band learning progressions are helpfully provided for each standard. For example, a seventh-grade standard is bracketed by the sixth-grade and eighth-grade outcomes, which helps educators track the progression of skills across grades. In addition, each standard is accompanied by a statement of suggestion ("To address this standard, students *could*..."), which provides a further level of support and guidance for educators, students, families, and curriculum developers. The standards are measurable and focus on outcomes at every level.

## − Clarity & Specificity Weaknesses

At the time of review, the standards lack many supporting resources of the sort typically offered by other states, such as a glossary, directions on reading and interpreting standards, vertical articulations of standards, a dedicated list of college- and career-readiness standards, and a crosswalk comparison of the previous standards with the new ones. This omission is deeply concerning given the state's timeline for implementing the standards is this fall—which gives educators very little time to learn about the new standards and plan for their implementation—and should be an area of immediate focus for the state.

# Recommendations

1. Create front matter and supporting documents that assist educators and others in making instructional, curricular, and assessment decisions. Priority documents should include links to existing text complexity tools, a glossary of terms, vertical articulation maps, and text exemplars.
2. Develop discipline-specific literacy standards for grades 6–12 to communicate expectations for use outside of the English classroom.
3. Designate specific literary and informational texts at all grade levels with which students should be familiar (or at minimum, provide exemplar texts for teacher consideration).
4. Include expectations for genres/subgenres and literary elements that should be mastered in the literature standards.
5. Create grade-specific English language arts standards for high school to clarify expectations at each grade level and eliminate duplication across grades.
6. Add specificity to citation requirements within the standards.

## = Bottom Line

Targeted revisions recommended along with a focus on implementation of these standards.

## Documents Reviewed

Kansas Standards for English Language Arts (adopted November 2017), accessed from http://community.ksde.org/LinkClick.aspx?file ticket=M8XHtjCrK0Q%3d&tabid=5559&mid=13575

## Endnotes

1. A representative from the Kansas State Department of Education (KSDE) estimated that additional supplemental resources would be available in late spring 2018. However, at the time of review, these resources were still unavailable, which is concerning, given the state's timeline to implement the standards this fall.

English Language Arts

# Missouri

10 9 **Strong**

*Recommend focus on the implementation of these standards.*

8 7 **Good**

*Targeted revisions recommended along with a focus on implementation of these standards.*

6 5 **Weak**

*Significant revisions recommended. Standards should not be implemented until and unless these revisions are made.*

4 3 2 1 **Inadequate**

***Complete revision highly recommended. Standards have critical shortcomings and should not be implemented.***

## Overall Rating: Inadequate (4/10)

Content & Rigor (3/7) + Clarity & Specificity (1/3)

## Overview

The English language arts (ELA) standards for the Missouri Public Schools have several noteworthy strengths. Unfortunately, these are undermined by several serious gaps in both substance and clarity. While the standards include strong foundational reading skills in grades K–5 and solid reading, writing, and speaking and listening standards in grades 6–12, the standards for grades K–5 and 6–12 are two separate documents that are poorly coordinated. In the latter, reading and writing are linked in thought-provoking ways, but the K–5 standards lack a clear developmental progression in the various skills to be taught. The standards for foundational literacy skills in reading (e.g., print awareness, phonemic awareness, phonics, fluency) are largely complete and consistent with current research findings; however, there are no comparable foundational standards for writing. And while the grades 6–12 standards require that students learn to read and comprehend literary and informational text, write well, and use speaking and listening effectively to support academic learning and communication, there are no standards for the specialized reading and writing demands of disciplinary subjects (such as science and history).

The standards are also undermined by a lack of specificity; for example, they indicate that text complexity is to increase over time, but they establish no specific levels of text complexity to be mastered. Similarly, the standards fail to specify any particular literary or public documents that students should know, and they largely ignore genres in grades 6–12, and subgenres and types of informational texts throughout. Several of the standards are not measureable, either because they prescribe activities or experiences rather than student learning outcomes or because they are vague. The standards also lack grade-specific standards for high school, so it is unclear how expectations and rigor should advance from grade to grade.

Despite some clear strengths, the lack of attention to disciplinary literacy, text complexity, and text genres, plus serious deficiencies in organization and clarity, cast serious doubt as to whether these ELA standards will lead to adequate college- or career-readiness for Missouri students.

# General Organization

The Missouri English language arts standards include learning requirements in four strands: Reading, Writing, Language, and Speaking and Listening. Individual grade level standards are defined for grades K–8. In high school, the grade level standards are reported in two-year bands (9–10 and 11–12). These standards are presented in several separate documents: two vertical articulation documents (K–5 and 6–12) that show the standards for each grade level (or grade band), a glossary, and a crosswalk that links the ELA standards with the state's social studies standards. The standards are also accompanied by a document that explains how to develop local curriculum that's aligned to the state's ELA standards.

# Content & Rigor

## + Content & Rigor Strengths

Missouri's ELA standards have several commendable strengths, particularly their strong attention to foundational reading skills in grades K–5 and solid reading, writing, and speaking and listening standards in grades 6–12.

The standards emphasize Reading Foundations in grades K–5 in the areas of print concepts, letters, phonemic awareness, phonics, and fluency. These skills are, for the most part, thorough and consistent with research identifying them as essential foundations. Appropriately, some of these areas are only addressed in particular grade levels (such as phonemic awareness in grades K–1), while other skills are emphasized across all of the elementary grades. The standards also include language expectations for grades K–5 that specify mechanics, usage, grammar, and spelling requirements.

Another strength is that K–5 reading standards emphasize the reading and analysis of both literary and informational texts. Fiction, poetry, and drama all have their own reading standards, which address various text features drawn from these genres (such as plot structure in fiction, or rhythm and rhyme in poetry). Some specific categories of informational text are required as well, such as reading biography and autobiography in third grade. The vocabulary standards in the elementary grades are specific and thorough, and vocabulary is also addressed—somewhat less explicitly—in the writing standards (e.g., 2.W.1.C.a: "Strengthen writing as needed by revising word choice," or 3.W.2.C.d: "Use transition words and phrases to signal event order").

The grade 6–12 ELA standards also wisely emphasize literary and informational text reading, as well as the importance of close reading and the use of text evidence to support comprehension. Yet these upper-grade standards do not address the importance of vocabulary growth in reading (however, precision of word choice is heavily and explicitly emphasized in the writing standards). The speaking and listening standards in these grades are focused on the uses of public or academic language, such as requiring students to "Speak clearly, audibly, and to the point, using conventions of language as appropriate to task, purpose, and audience when presenting" (6.SL.2.A, 7.SL.2.A), which is appropriate.

## – Content & Rigor Weaknesses

Missouri's ELA standards have several serious shortcomings that undermine their ability to support the preparation of students for college- and career-readiness. The K–12 standards mention many key skills and abilities students should master, but these are often vague or poorly developed across grade levels. For example, although composition begins in kindergarten, there are no standards requiring that children learn to print, write, or keyboard that early. The first mention of these skills is in the grade 2 standards that expects teachers to "introduce keyboarding skills" (2.W.1.D.b). As a result of these uneven learning progressions, writing expectations for kindergarten and first-grade students are unclear. Additionally, reading fluency is not addressed at all in grades 6–12, despite evidence that students' reading fluency is still likely to be developing at this point.

Missouri's reading standards are also often vague in terms of student outcomes. For example, a fifth-grade standard requires students to "read appropriate texts with fluency (rate, accuracy, expression, appropriate phrasing), with purpose, and for comprehension" (5.RF.4.A.a). However, as written, this standard lacks specific criteria for determining whether a student has mastered this skill, and it is unclear

what would qualify as an appropriate text, and what rate and level of accuracy is acceptable for grade 5. This standard also confusingly includes reading comprehension as a component of fluency skill, when the purpose of developing fluency in reading is to enable or improve reading comprehension.

Lack of specificity is especially problematic with regard to text complexity. While the standards correctly note that, "as students mature and grow as readers, the text level should become more complex," the standards lack any specificity as to the quantitative, qualitative, or reader/task specific criteria that texts must evidence to be appropriately complex. This omission undermines almost all of the reading standards since it fails to ensure that students will be implementing the various skills or abilities required by the standards with texts of appropriate or sufficient complexity. Thus, a fifth-grade student may be able to "analyze how the pattern of organization of a text influences the relationships," but it is not clear whether such a student could do this with texts of sufficient complexity.

This weakness is compounded by a lack of any specific text reading requirements. The standards fail to specify that students have knowledge of any literary classics or public documents, and there are no text exemplars provided for any grade level. The standards do not even specify broad categories of literature with which students should be familiar (e.g., mythology, American literature, or British literature). With neither text complexity requirements nor exemplars, the standards are ambiguous and what students are to learn is left largely to teacher discretion.

Additionally, the standards fail to specify subgenre requirements in the elementary grades and genre reading requirements for grades 6–12. They also fail to establish any language or literacy requirements for reading disciplinary texts in history or science. This omission is particularly worrisome, as research has demonstrated that the unique or specialized quality of texts in the various disciplines and college readiness depends upon students having more than a general awareness of such texts.

Finally, the standards are weak with regard to learning how to conduct research and use media sources. Each of these is addressed in a single standard at each grade level, which is insufficient coverage for these important skills.

# Clarity & Specificity

## + Clarity & Specificity Strengths

The language used in Missouri's ELA standards is mostly clear and free from jargon. Some of the standards emphasize clear learning goals. For example, third-grade students should be able to "summarize and sequence the events/plot and explain how past events impact future events" (3.R.2.A.a), and eighth-grade students should be able to "explain the central/main idea(s) of a text and analyze its development over the course of a text; provide an objective summary of the text" (8.RI.1.D). In the secondary grades, students are expected to provide close readings of texts with an explicit reliance upon text evidence (a criterion not evident in the elementary grades). Additionally, the speaking and listening standards target valuable academic skills, such as "delineate a speaker's argument and claims, evaluating reasoning and sufficiency of evidence in order to pose questions that connect the ideas of several speakers and respond to others' questions and comments with relevant evidence, observations, and ideas" (8.SL.1.B).

The Missouri reading and writing standards are organized into three categories in grades 6–12: "approaching texts as a reader," "approaching texts as a writer," and "approaching texts as a researcher." Reading and writing depend on many of the same language skills and share important similarities as they are both parts of a communications process. This structure—along with the attempt to connect the ELA and social studies standards through a crosswalk document—is innovative and welcome, since it attempts to stress connections that talented teachers can successfully exploit.

The grades 6–12 standards also provide clear progressions from one grade level to the next for the various skills and abilities. For instance, the standards indicate that students are supposed to identify themes in literary texts (RL.1.D). In grade 7, students are to determine a text theme using text evidence (7.RL.1.D); in grade 8, they have to show the development of a theme across a text (8.RL.1.D); in grades 9–10, they must identify two themes, and so on (9–10. RL.1.D).

## Clarity & Specificity Weaknesses

Missouri's standards suffer from serious clarity and specificity problems. They often focus on activities or experiences rather than measurable student outcomes, and they're poorly organized and hard to follow.

For instance, the standards include items that are not easily measured; that is, they are not linked to any clear criterion or normative standard. Too often these standards fail to specify what it is that students must learn or learn to do, only prescribing activities for students or pointing out experiences that students should have—such as the requirement that students read independently for multiple purposes or periods of time and produce "evidence of reading" (1.R.1.D.b) or that they "follow a writing process to plan a first draft by brainstorming and recording ideas using a graphic organizer" (2.W.1.A.a).

Several standards include language that is either too complicated or vague to be useful. For example, writing standard 2A requires students in grades 9 and 10 to "follow a writing process to produce clear and coherent writing in which the development, organization, style, and voice are appropriate to the task, purpose, and audience; self-select and blend (when appropriate) previously learned narrative, expository, and argumentative writing techniques." Yet no previously learned writing techniques are specified, resulting in inadequate guidance to educators trying to prepare students for college-level writing assignments.

The coordination of the K–5 and 6–12 standards is particularly cumbersome and hard to follow. For instance, in grades K–5, there are standards for both Reading and for Reading Foundations. The Reading standards are divided into four categories:

1. Develop and apply skills to the reading process;
2. Develop and apply skills and strategies to comprehend, analyze, and evaluate fiction, poetry, and drama from a variety of cultures and times;
3. Develop and apply skills and strategies to comprehend, analyze, and evaluate nonfiction (e.g., narrative, information/explanatory, opinion, persuasive, argumentative) from a variety of cultures and times; and
4. Comprehend and analyze words, images, graphics, and sounds in various media and digital forms to impact meaning.

In contrast, the reading standards for grades 6–12 are divided into "reading literary text" and "reading informational text," then further divided into three parts:

1. Approaching texts as a reader;
2. Approaching texts as a writer; and
3. Approaching texts as a researcher.

Either of these organizational approaches—the one used in K–5 or the one used in grades 6–12—is defensible. Having both of them, however, is confusing and fails to show how the progression of related knowledge and skills builds across grade levels. Although the document includes marginal notes intended to link the two sets of standards, they are insufficient to the task. A uniform K–12 framework would allow teachers, parents, and students a clearer vision of what is expected.

As indicated, the grades 6–12 standards present mostly clear learning progressions for the particular skills. However, in the elementary grades, this developmental quality is missing. For example, kindergartners are expected to "identify elements of a story, including setting, character, and key events" (K.R.2.A.a); students in grade 1 are to "describe characters, setting, problem, solution, and events in logical sequences" (1.R.2.A.a); grade 2 students are to "describe the setting, problems, solutions, sequence of events (plot), and big idea or moral lesson" (2.R.2.A.a); grade 3 students are to "summarize and sequence events/plot" (3.R.2.A.a). Rather than demonstrate development across grades, these standards use different terminology to describe the same things repeatedly. In other cases, particular skills appear to be relegated to particular grade levels with no evident carryover to future grades.

Finally, the high school standards are clustered for grades 9–10 and 11–12, and are not specific as to the requirements of particular grade levels. As a result of the combination of grade level expectations, the standards may lead to duplication of effort across grades, or worse, gaps in learning.

# Recommendations

1. Develop a single standards document for grades K–12. These standards should explicitly articulate what Missouri students need to know when they graduate from high school, and specify how this learning should progress across the grades.
2. Create grade-specific English language arts standards for high school to clarify expectations at each grade level and eliminate duplication across grades.
3. Establish text complexity requirements that specify particular text complexity levels that students should be able to read at the various grade levels.
4. Omit non-measurable standards that do not articulate learning outcomes (e.g., such as those that prescribe that students engage in the writing process or independent reading), clarify vaguely written standards, and better coordinate standards across grades.
5. Develop discipline-specific literacy standards for grades 6–12 to communicate expectations for use outside of the English classroom.
6. Include expectations for genres/subgenres and literary elements that should be mastered in the literature standards.
7. Develop and include writing foundations standards in the primary grades.
8. Designate specific literary and informational texts at all grade levels with which students should be familiar (or at minimum, provide exemplar texts for teacher consideration).

## Bottom Line

Complete revision highly recommended. Standards have critical shortcomings and should not be implemented.

## Documents Reviewed

- Missouri Learning Standards for English Language Arts (October 2017), accessed from https://dese.mo.gov/college-career-readiness/curriculum/missouri-learning-standards#mini-panel-mls-standards1.doe.in.gov/standards/englishlanguage-arts;
- ELA Crosswalk K–5, accessed from https://dese.mo.gov/sites/default/files/cur-mls-crosswalk-ela-K-5.pdf;
- ELA Crosswalk 6–12, accessed from https://dese.mo.gov/sites/default/files/cur-mls-crosswalk-ela-6-12.pdf;
- Communication Arts Glossary, accessed from https://dese.mo.gov/sites/default/files/curr-ela-glossary-of-terms.pdf.

English Language Arts

# Nebraska

10 9 — **Strong**

*Recommend focus on the implementation of these standards.*

8 7 — **Good**

*Targeted revisions recommended along with a focus on implementation of these standards.*

6 5 — **Weak**

***Significant revisions recommended. Standards should not be implemented until and unless these revisions are made.***

4 3 2 1 — **Inadequate**

*Complete revision highly recommended. Standards have critical shortcomings and should not be implemented.*

## Overall Rating: Weak (5/10)

Content & Rigor (3/7) + Clarity & Specificity (2/3)

## Overview

The Nebraska College- and Career-Ready English Language Arts (ELA) Standards are well organized and clearly written, and have several notable content strengths. The standards generally align with current research on the importance of the development of foundational skills in reading, and the comprehension and vocabulary strands in reading are equally solid. The standards also include an innovative strand on multiple literacies, which includes ethical use of materials and technologies.

Yet several critical gaps detract from the standards, most importantly the absence of clear text complexity expectations and a lack of grade-specific standards for high school. Also missing are text exemplars or specific works of outstanding literature and culturally important informational texts—a fundamental flaw in these standards. In addition, there is no mention of disciplinary literacy at the secondary level, which is vital for development of college- and career-readiness (CCR). Although there are four standards labeled CCR, they are vague and not measureable as stated. Finally, the writing domain favors process over production, with relatively little attention given to the development of writing skills for specific text types—particularly informational and expository writing, and argumentation and rhetorical writing.

## General Organization

Nebraska's college- and career-ready ELA standards are divided into four domains: Reading, Writing, Speaking and Listening, and Multiple Literacies. Each domain is further segmented into two to six strands (Table 1). There is no rationale or overview of the research used to construct the standards, although there are two appendices: *Frequently Asked Questions* and a glossary of terms.

## Table 1. Nebraska's ELA Domains and Strand Divisions

| Reading | Writing | Speaking & Listening | Multiple Literacies |
|---|---|---|---|
| Concepts of Print | Writing Process | Speaking | Information Fluency |
| Phonological Awareness | Writing Modes | Listening | Digital Citizenship |
| Word Analysis | | Reciprocal Communication | |
| Fluency | | | |
| Vocabulary | | | |
| Comprehension | | | |

Individual grade level standards are defined for K–8. In high school, the standards are reported in two-year bands (9–10 and 11–12.) The standards are articulated both vertically (across grade levels) and horizontally (within a single grade level) to illustrate a learning progression—i.e., the way the standards evolve across the grade levels from K–12. Standards for literacy in other disciplines are not included.

# Content & Rigor

### + Content & Rigor Strengths

The strands identified in the reading standards are thorough and complete, and are consistent with current research on the components of reading development (i.e., phonemic awareness, phonics, fluency vocabulary, and comprehension). Similarly, the Writing and Speaking and Listening strands are logical and aligned with current literacy research. Another strength is attention to multiple literacies, which includes digital and multimedia forms of expression.

The specific attention to digital citizenship is also commendable, and represents the leading edge of media literacy as it relates to curriculum. Specifically, this domain specifies "ethical use of information" as well as attention to copyright guidelines, although it is doubtful that the latter has much relevance in the primary grades (LA 0.4.1b). The Speaking and Listening domain casts a light on reciprocity in communication, requiring students to "demonstrate awareness of and sensitivity to the appropriate use of words" (LA 0.3.3.b–LA 12.3.3.b) and "convey a perspective with clear reasoning and valid evidence" (LA 7.3.1.d). These standards go beyond the social expectations of communication by also emphasizing the importance of disagreement and consensus building in discussion.

### – Content & Rigor Weaknesses

Several major content omissions blunt the effectiveness of these standards. The first is the standards' failure to discuss text complexity, an omission that leaves the choice of texts wide open for interpretation. Although text complexity is defined in the glossary ("the qualitative and quantitative features of text that determine its level of difficulty; text complexity includes considerations related to the reader and the reading task"), it's never elaborated further. Instead, students are expected to "listen to and read texts of increasing length and/or complexity to increase reader stamina" from grades 2–4 (LA 2.1.4.a–4.1.4.a), and to "use reading strategies to persevere through text of increasing length and/or complexity" in grades 5–8 (LA 5.1.4.a–8.1.4.a.).

There is no guidance on which quantitative and qualitative features are being referred to, nor are there any examples of what would constitute appropriate levels of difficulty. Examples and exemplars are not provided either, an omission compounded by scant mention of genres and subgenres that should convey a wide range of texts. For example, autobiographies, essays, speeches, satire, epic poetry, and mythology are missing. Without clear and specific definitions and expectations that demonstrate a rising level of text complexity across grades, teachers must rely solely on personal or local expectations, which are often informal

and unstated. Put simply, clear definitions and expectations about the complexity of texts should anchor the standards and convey their intended rigor. Such additions would contextualize the reading comprehension standards and (if well implemented) would ensure that students follow an appropriate path to college and career readiness.

Second, verbatim repetitions across multiple consecutive grade levels mean that the standards remain static and fail to convey clearly the ways in which skills should systematically built year upon year. Each of the following standards, for example, is repeated verbatim in at least five consecutive grades:

- *Reading: Demonstrate an understanding of text via multiple mediums (e.g., writing, artistic representation, video, other media) (LA 1.1.6.o–5.1.6.o).*
- *Reading: Select text for a particular purpose (e.g., answer a question, solve problems, enjoy, form an opinion, understand a specific viewpoint, predict outcomes, discover models for own writing, accomplish a task), citing evidence to support analysis, reflection, or research (LA 5.1.6.k–12.1.6.k).*
- *Writing: Use precise word choice and domain-specific vocabulary to write in a variety of modes (LA 0.2.2.d– 12.2.2.d).*
- *Writing: Conduct and publish both short and sustained research projects to answer questions or solve problems using multiple primary and/or secondary sources to support theses (LA 7.2.2.c).*

The omission of text complexity expectations magnifies the vagueness of these learning progressions. For instance, standard LA 0.2.2.d on word choice in writing would be strengthened by examples so that users can further see how this expectation evolves over the grade levels. As written, it is left entirely to the individual to interpret how this standard should progress from grade to grade. Similarly, the lack of grade-specific standards for high school makes it unclear how expectations and rigor should advance in subsequent grades.

A third content weakness pertains to text types and disciplinary literacies. Lumping "literary and informational texts" in one strand fails to acknowledge the unique demands of each, as students should approach, analyze, and understand these texts differently. For example, informational texts should be sourced by the reader, while literary texts are often contextualized by the era in which they were composed. Additionally, there are no standards specifying that students should learn to deal with text types and text features that are unique to several disciplines. Reference to other disciplines is spotty, general, and infrequent (e.g., "Word Analysis: Students will use knowledge of phonetic and structural analysis to read and write grade-level text across all disciplines" (LA 7.1.3)). As students enter middle school, they increasingly encounter text types and discipline-specific literacy expectations, and must be equipped to handle texts, use formal reasoning, and address rhetorical structures that vary depending on the discipline. Discipline-specific approaches are appropriate for the specialized reading demands of the disciplines (e.g., determining theme in literary works, sourcing information in history, comparing prose and graphic sources in science reading). However, they are not specified anywhere in Nebraska's standards.

The standards are also flawed by their imbalance in writing, with excessive emphasis on writing processes (ten standards), and corresponding de-emphasis on producing writing, with only three standards devoted to modes, purpose, and audience. The laundry list of modes is particularly troubling—analytic, argumentative, descriptive, informative, narrative, poetic, persuasive, and reflective are all listed in a single standard—with no guidance on the characteristics or purposes for each. They are not named in the glossary, and the single standard does not evolve—and therefore does not articulate any learning progression to show how skill and aptitude develop over time.

Take argumentative writing as an example. We find nothing about how such writing is developed (claims, evidence, reasoning, rhetorical structures of writing), even though mastery of this rhetorical style takes years to develop. Reasoning is required in argumentation, but is only mentioned in the context of speaking and listening, not writing.

Without learning progressions that reflect the unique elements of these writing modes, teachers are left to somehow cause writing to occur, rather than explicitly teach toward acquisition, consolidation, and mastery of these skills. The expectation for writing production—another indicator of rigor—is vague and open to wide interpretation, stating only that writing tasks should be "of increasing length and complexity" (LA 3.2.1.g–12.2.1.g) Without clear expectations about production and complexity, definitions of "grade-level work" are left open to interpretation. These additions and improvements would clearly convey increasing rigor as students progress through the grade levels.

# Clarity & Specificity

## + Clarity & Specificity Strengths

The format of the standards is logical and user-friendly, enabling users to view them both within grade levels and across learning progressions. The appendices include a FAQ section to address common questions, and a glossary provides further support for teachers, students, curriculum directors, and textbook writers. The standards are also helpfully laid out both vertically and horizontally.

## – Clarity & Specificity Weaknesses

While the standards follow a logical structure, several organizational limitations interfere with their clarity. The first is the inclusion of superfluous reading standards that are not developmentally appropriate, simply because it is consistent with the organizational structure. For example, while emergent reading skills (e.g., concepts of print, phonemic and phonological awareness, decoding) are foundational and essential for mastery in the primary grades, they are continually referred to through twelfth grade. The continuation of these previously mastered foundational standards through twelfth grade is unnecessary and detracts from other grade-appropriate standards.

Additionally, the standards' lack of detail and specificity in the college- and career-readiness standards renders them somewhat unhelpful to users and consumers. Only four broad CCR standards are identified, one for each domain. The purpose of CCR standards is to depict outcomes that define the skill level and dispositions expected for graduates as they move into post-secondary education and work. As such, the CCR standards for Nebraska read more like goal statements than measurable performance standards:

- *Students will learn and apply reading skills and strategies to comprehend text.*
- *Students will learn and apply writing skills to communicate.*
- *Students will develop and apply appropriate speaking and listening skills and strategies to communicate for a variety of purposes.*
- *Students will apply information fluency and practice digital citizenship.*

Such nebulous and generic standards do little to signal to the public, students, teachers, and future employers what Nebraska graduates will know and be able to do. This lack of clarity and specificity related to CCR represents a gulf between how students are being prepared versus what they are being prepared for. These outcome intentions are further obscured by the aforementioned lack of clear expectations for a rising level of text complexity. Taken together, the silence on text complexity and the vagueness of the CCR standards muffle otherwise promising standards.

# Recommendations

1. Design college- and career-readiness standards to anchor learning progressions from K–12.
2. Establish text complexity requirements that specify particular text complexity levels that students should be able to read at the various grade levels. Such exemplars should include a variety of genres and subgenres to further clarify expectations.
3. Designate specific literary and informational texts at all grade levels with which students should be familiar (or at minimum, provide exemplar texts for teacher consideration)
4. Re-examine the present learning progressions to add detail and nuance at each grade level, and remove the many verbatim repetitions of skills and dispositions in favor of nuanced standards that evolve and progress year after year.
5. Create grade-specific English language arts standards for high school to clarify expectations at each grade level and eliminate duplication across grades.
6. Revise writing standards to translate writing process standards into requirements that can be taught and measured. Eliminate standards that are only activities and provide more detail regarding the production of various text types, especially argumentation, and the skills associated with each text type.
7. Develop discipline-specific literacy standards for grades 6–12 to communicate expectations for use outside of the English classroom. If these do in fact exist in other documents (our review covers the standards only), they should be cross-referenced in the ELA standards.

### Bottom Line

Significant revisions recommended. Standards should not be implemented until and unless these revisions are made.

## Documents Reviewed

Nebraska College- and Career-Ready English Language Arts Standards (adopted September 4, 2014), accessed from https://www.education.ne.gov/read/.

English Language Arts

# New York

10
9
**Strong**
*Recommend focus on the implementation of these standards.*

8
7
**Good**
***Targeted revisions recommended along with a focus on implementation of these standards.***

6
5
**Weak**
*Significant revisions recommended. Standards should not be implemented until and unless these revisions are made.*

4
3
2
1
**Inadequate**
*Complete revision highly recommended. Standards have critical shortcomings and should not be implemented.*

## Overall Rating: Good (7/10)

Content & Rigor (5/7) + Clarity & Specificity (2/3)

## Overview

The New York State Next Generation English Language Arts (ELA) Learning Standards were adopted in 2017 but will not be fully implemented until September 2020. Overall, the standards are clear and well written. They lay out a strong regimen of learning requirements from prekindergarten through grade 12 that will support many students' college and career aspirations. They also include helpful support documents, such as an introduction to the standards, which aid in their implementation. However, several areas need improvement. Foremost among these is a lack of specific learning requirements regarding teaching students to read texts of particular levels of text complexity, and a lack of guidance on selecting specific literary works and documents of which students should have knowledge. The standards also lack grade-specific standards for high school, which make it unclear how expectations and rigor are to advance from grade to grade.

## General Organization

The New York State Next Generation English Language Arts Learning Standards, and New York State Literacy in History/Social Studies, Science, and Technical Subjects are organized into three distinct sections: 1) Prekindergarten and Elementary Standards, 2) Middle Grade Standards, 3) High School Standards, with an additional document focused on Literacy in History/Social Studies, Science, and Technical Subjects in grades 6–12. The ELA standards focus on Reading, Writing, Speaking and Listening, and Language at all grade levels, and there is an additional Reading Foundations section for Prekindergarten–Elementary.

The standards are articulated both horizontally and vertically across the grade levels. Each standard is associated with College- and Career-Readiness (CCR) standards that provide a consistent strand from K–12 (called Anchor Standards).[1] Thus, each grade-specific standard can be viewed along with the other grade-specific standards, and cumulatively across the grades. For example, Reading Anchor Standard 6 requires that students learn to "assess how point of view or purpose shapes the content and style of a text, drawing on a wide range of global and diverse texts." This standard is addressed in pre-K, with the requirement that students "describe the role of an author and illustrator" (PKR6), in second-grade, where students are to "identify examples of how illustrations, text features, and details support the point of view or purpose of the text" (2R6), and again in eighth grade, where students are to analyze "how the differences between the point of view, perspectives of the characters, the audience, or reader create effects such as mood and tone" in literary works and "how the author addresses conflicting evidence or viewpoints" (8R6). Individual grade-level standards are defined for grades K–8. In high school, the grade-level standards are reported in two-year bands (9–10 and 11–2); two-year bands are also used throughout the language standards.

# Content & Rigor

## + Content & Rigor Strengths

Overall, the New York State ELA standards provide educators with a reasonable degree of focus, coherence, and rigor. They present learning requirements clearly for the most part, without the distraction of superfluous items, and emphasize measurable student outcomes over learning processes. Coordination with preschool standards is a major strength. For example, the standards include Foundational Skills in Reading for preschool and elementary students, including Print Concepts and Phonological Awareness (pre-K–1), Phonics and Word Recognition, and Fluency (pre-K–5). These standards are appropriately sequenced, though their focus is general, referencing categories of things that need to be taught ("decode some regularly spelled one-syllable words" (KRF3c)), rather than more specific delineations of the actual words or spelling patterns to be mastered. Vocabulary is also emphasized thoroughly through the Language standards, and this theme is also carried through the Reading, Writing, and Speaking and Listening standards, ensuring plenty of instructional emphasis on developing word meanings. The Reading standards are concise, rigorous, and focus on basic comprehension as well as critical reading (for instance, Reading Standard 8, which requires students to learn to evaluate the adequacy of evidence in an argument).

New York's reading standards also call for an appropriate balance of reading informational texts and literature, but they combine these emphases into a single standard, rather than include separate standards for literary and informational reading. For example, 7R2 asks students to "determine a theme or central idea of a text and analyze its development over the course of the text," with theme being a literary concept and central idea being its analogous counterpart in informational text. Addressing both literature and informational text together reduces the number of independent standards to be met, and may be less overwhelming to teachers. Nevertheless, there are times when the combination does not work well, which led to the inclusion of separate standards for the reading of these different texts.

The New York standards include disciplinary literacy standards in the middle and high school grades, and research standards throughout. This approach recognizes that social studies/history and science and technical subjects require reading texts that have different features and different purposes. For example, history reading requires a critical consideration of author perspective, while science reading relies upon a relatively greater integration of information expressed in prose with graphical and quantitative information. The New York ELA standards require students to learn these more specialized reading routines, and to learn to conduct research (including how to establish research questions, locate information, and to use this information for various types of reporting).

The New York State Writing standards are similarly succinct and emphasize learning outcomes over writing *activities*. This increases the degree to which the reading and writing standards coordinate and keeps the emphasis on learning versus process.

## − Content & Rigor Weaknesses

These many strengths are balanced against equivocal attention to teaching students to make sense of complex texts, a lack of foundational writing standards, and failure to provide specifics about literary genres, subgenres or informational text types that students need to master. Many of the specific text features that characterize these text types are also ignored.

Additionally, the standards are silent about specific literary texts or important historical documents with which students should be familiar, such as the writings of Shakespeare. The decision to include (or not) specific text requirements boils down to whether one views specific texts as cultural touchstones that offer essential knowledge that all students should share, or as mere curriculum devices for providing students practice with reading skills. Given the importance of shared knowledge in a democracy, as well as the need to thoughtfully and sequentially build such knowledge, silence is the wrong response.

The New York State standards are also silent regarding text complexity in grades 2–12. While the reading standards include introductory statements requiring students to read and comprehend texts "that are appropriately complex or above grade level," no standards specify the levels of text that students need to learn to read—and the instructional guidance given by the standards could be interpreted to mean that students do not need to read grade-level texts (see *Clarity & Specificity Weaknesses*). This is a serious omission since the reading skills themselves have no real meaning outside the context of texts of particular levels of difficulty.[2]

Finally, the standards do not include Foundational Writing standards (though spelling is addressed in the Language standards). High school standards are also presented in grade bands, so there is no differentiation between standards for grades 9 and 10 and grades 11 and 12. This lack of specificity makes it unclear how expectations and rigor should increase across grades.

# Clarity & Specificity

## + Clarity & Specificity Strengths

The New York State Standards are clear, specific, and generally well organized. It is easy to track the progression of particular skills across grade levels and the language is relatively plain and jargon free. The standards helpfully combine the literature and informational text standards, which avoids needless repetition.

The standards are concise in part due to the inclusion of a glossary and an appendix with specific details concerning the Language standards. This approach allows the standards to be presented with great clarity. For instance, a standard can require that students learn punctuation or spelling skills without listing all of the spelling patterns or punctuation rules that must be mastered since these are available in the appendix.

## – Clarity & Specificity Weaknesses

The clarity of the standards is reduced by the inclusion of pages of "instructional guidance" within the documents, which makes it difficult for educators to ascertain what constitutes required student learning and what is no more than instructional advice. (Though there are instances when the advisory guidance is distinguishable, such as with the suggestions for how to create appropriate classroom environments).

More problematic is the lack of a text complexity standard. While New York students are not required to learn to read texts of any particular level of difficulty, the instructional documents nonetheless provide copious guidance around this omitted requirement. For instance, in second grade, the instructional guidance indicates that teachers should provide students with "authentic opportunities to engage with texts that specifically correlate to their individual level of word reading skills," which could be interpreted to mean that students do not need to read grade-level texts.

Absent rigorous quantitative and qualitative expectations for text complexity, it's unclear what level of texts students should be exposed to, and how text complexity should advance across grades. The implication of this omission becomes increasingly problematic as students advance up the grades; being able to implement the various reading standards successfully with below-grade-level texts will not ensure college- or career-readiness.

# Recommendations

1. Establish text complexity requirements that specify particular text complexity levels that students should be able to read at the various grade levels.
2. Designate specific literary and informational texts at all grade levels with which students should be familiar (or at minimum, provide exemplar texts for teacher consideration).
3. Include expectations for genres/subgenres and literary elements that should be mastered in the literature standards.
4. Create grade-specific English language arts standards for high school to clarify expectations at each grade level and eliminate duplication across grades.
5. Separate instructional guidance from the learning requirements specified by the standards.

## Bottom Line

Targeted revisions recommended along with a focus on implementation of these standards.

## Endnotes

1. CCR standards anchor grade-level standards by including the final outcome expectations for high school graduates.
2. For a more positive take on the New York's Next Generation English Language Arts Learning Standards and their guidance regarding text complexity, see Achieve Inc.'s Strong Standards report: https://www.achieve.org/files/StrongStandards.pdf.

## Documents Reviewed

- Preface to the New York State Next Generation English Language Arts and Mathematics Learning Standards (Revised 2017), accessed from http://www.nysed.gov/common/nysed/files/ela-and-mathematics-standards-preface.pdf.
- Introduction to the New York State Next Generation P–12 English Language Arts Learning Standards (Revised 2017), accessed from http://www.nysed.gov/common/nysed/files/introduction-to-the-nys-english-language-arts-standards.pdf.
- New York Next Generation English Language Arts Learning Standards, accessed from http://www.nysed.gov/common/nysed/files/nys-next-generation-ela-standards.pdf.
- Introduction to the New York State Next Generation Grades 6–12 Learning Standards for Literacy in History/Social Studies, Science, and Technical Subjects, accessed from http://www.nysed.gov/common/nysed/files/nys-next-generation-literacy-standards-grades-6-12.pdf.
- New York State Next Generation Grades 6–12 Learning Standards for Literacy, accessed from http://www.nysed.gov/common/nysed/files/nys-next-generation-literacy-standards-grades-6-12.pdf.

English Language Arts

# North Carolina

10
9
**Strong**
*Recommend focus on the implementation of these standards.*

8
7
**Good**
***Targeted revisions recommended along with a focus on implementation of these standards.***

6
5
**Weak**
*Significant revisions recommended. Standards should not be implemented until and unless these revisions are made.*

4
3
2
1
**Inadequate**
*Complete revision highly recommended. Standards have critical shortcomings and should not be implemented.*

## Overall Rating: Good (7/10)

Content & Rigor (5/7) + Clarity & Specificity (2/3)

## Overview

North Carolina's Standard Course of Study for English Language Arts (ELA) was adopted in April 2017 and will be implemented in the 2018–2019 school year. The standards are generally well organized and easy to follow, and tend to focus on measurable student outcomes more than on learning processes. Other strengths are the Foundational Skills Reading standards, which are particularly strong and well sequenced, and the Language standards, which are helpfully divided into two continua, one for grammar and one for conventions. Strong Speaking and Listening standards require students to communicate orally in a variety of contexts. The state's writing standards are also notably coherent, comprehensive, and specific as to student writing outcomes.

However, these strengths are undermined by redundancy in reading and writing expectations across grades, and by the absence of specific requirements for text complexity and text exemplars. The standards also lack any mention of disciplinary literacy and are vague regarding genres and subgenres of text.

## General Organization

North Carolina's ELA standards are organized into six strands: Reading Literature, Reading Informational Text; Reading Foundational Skills; Writing; Speaking and Listening; and Language. Each strand is accompanied by an explanatory paragraph detailing what students should understand and be able to do by the end of each grade. Under each of these strands (except Reading Foundational Skills) are College and Career Readiness (CCR) anchor standards, which anchor grade-level standards by including the final outcome expectations for high school graduates. For example, there are ten CCR anchor standards under the Reading Literature

strand, such as CCR Anchor Standard RL.10, which specifies that students should "Read and understand complex literary and informational texts independently and proficiently, connecting prior knowledge and experiences to text."

As noted, reading is separated into three categories: literature, informational text, and foundational skills. While literature and informational text standards are indicated for all grades (K–12), foundational skills—which include print concepts, phonological awareness, phonics and word recognition, fluency, and handwriting—understandably end in the fifth grade. The writing standards emphasize three text types: arguments (W.1), informative/explanatory texts (W.2), and narratives (W.3). The Speaking and Listening strand stresses that students should learn how to contribute to "a variety of rich, structured conversations." Uniquely, the first two of the six CCR Language standards are divided into two continua: one on grammar and one on conventions.

Individual grade-level standards exist for grade K–8 but high school grades are presented in two-year bands (9–10 and 11–12). Supporting materials for each grade level are available through North Carolina's website, notably in *Understanding the NC English Language Arts Standard Course of Study*. These documents include grade-level standards and "clarifications": Each standard is presented next to an explanation, ideas for instruction, examples, and a glossary of important words. In fact, one of the biggest changes to the state's ELA standards is moving the explanatory phrases and details that once existed in the 2010 version to the "clarifications" section of this new supplemental resource, thereby drastically reducing the size—and unfortunately, the specificity—of the 2017 standards.

# Content & Rigor

## + Content & Rigor Strengths

North Carolina's ELA standards focus on the essential domains of literacy and have several notable strengths. First, the Reading Foundational Skills standards provide a careful sequence of phonemic awareness and phonics skills. For example, fluency is developed from kindergarten through fifth grade; by third grade, students are expected to use word analysis with multisyllabic words (i.e., they are expected to know and use Latin suffixes, such as in the words "project" or "contradict").

Importantly, the reading standards also distinguish between the reading of literary and informational texts. Within Reading Literature, there is a focus on using text to support inferences, which underscores the importance of close reading. These strengths allow students to clearly differentiate literary and informational text and to support analyses with textual evidence.

The writing standards are also strong in their focus on text types (arguments, informative/explanatory texts, and narratives). They are comprehensive, and objectives about the writing process are rolled up into stronger capstone standards on text types, specifically CCR Anchor Standards W.1, W.2, and W.3. Overall, the writing expectations focus on specific student outcomes, rather than processes. For example, in grade 4, students are expected to write an opinion piece supporting a point of view with reasons and information. This standard includes specific expectations that together comprise a road map for students to reach the outcome: 1) Students are to introduce the topic, state an opinion, and create an organized structure; 2) Students are to provide reasons supported by facts and details; 3) Students are to link opinions and reasons with words and phrases; and 4) Students are to provide a concluding statement relevant to their opinion.

The Language standards are intended to be integrated throughout other domains. They focus on grammar and conventions, which have been separated into two unique continua that parallel one another developmentally. In higher grades, the standards require students to apply these skills in complex texts. Other standards in the domain address functions, syntax, and vocabulary. For instance, in CCR Anchor Standard L.4, students are expected to clarify the meaning of unknown and multiple-meaning words and phrases in their reading.

## − Content & Rigor Weaknesses

Multiple content weaknesses undermine North Carolina's ELA standards. First, there are numerous instances where standards mirror or replicate one another, with little distinction in expectation from one grade level to the next. These similarities in grade-level standards are even more problematic as the standards fail to include specific expectations for text complexity. Although grade-level standards within CCR Anchor Standards RI.10 and RL.10 refer to text complexity bands, these are not defined within the standards document, and educators must refer to supporting documents for this information.

In addition, North Carolina's reading standards are generic and lack examples or details about genres and subgenres of text beyond a mention of the broad categories, such as poetry and drama. In fact, explanatory phrases suggesting genres and subgenres have deliberately been removed from the standards in the 2017 revision and housed in the "clarifications" document as described above. For example, the 2017 standard below deletes key details (see strike-through) that once appeared in 2010:

> *Compare and contrast texts in different forms or genres (~~e.g., stories and poems, historical novels, and fantasy stories~~) in terms of their approaches to similar themes and topics (RL.6.9).*

There is no mention of reading foundational historical documents (in fact, a reference to the Declaration of Independence and other documents was removed from RI.11–12.9), no mention of reading literature from other cultures, no expectation that students will read a mix of classical and contemporary pieces, and no mention of specific literary works or authors (such as Shakespeare) that students should know. Reading across genres, subgenres, and a wide variety of texts is critical for building students' content knowledge, and these deficiencies are significant.

Finally, the standards lack any mention of disciplinary literacy within the Informational Text strand, nor are there any discipline-specific literacy standards for grades 6–12. Mathematics, history, and science texts have different features and purposes; students need to understand these differences in order to comprehend these texts and to write in a similar manner.

There are also redundancies in writing expectations across grade levels. For instance, elementary students are expected to write opinion pieces, but the standard on this topic changes little from grade 3 to grade 5. Similarly, students' use of digital tools (W.4) is mentioned in K–12 with little differentiation in expectations across these thirteen grade levels. Oddly, the expectation to write research reports using digital tools is only included in high school. The repetition of outcome expectations continues in the language standards, where the objectives for CCR Anchor Standard L.4 are quite similar across the grades ("Determine or clarify the meaning of unknown and multiple-meaning words and phrases by using context clues, analyzing meaningful word parts, and consulting general and specialized reference materials, as appropriate"). Once again grade-specific details from the 2010 standards, such as "Determine the meaning of the new word formed when a known affix is added to a known word " (L.K.4), have been removed from the standards and are available only as "clarifications" in a separate document, leaving the grade-level objectives for L.4 with little development. The standards reference grade-specific "reading and content" each year, but without clear text complexity expectations outlined within the standards document, it is unclear how those specifications will be honored. The state's high school standards are also reported in two-year bands rather than for individual grades, which muddies the progression of rigor for high school students.

# Clarity & Specificity

## + Clarity & Specificity Strengths

Overall, the standards are fairly well organized, jargon-free, and accompanied by many resources that support their implementation (including guidance on academic vocabulary, close reading, text-dependent questions, and text complexity). The standards themselves are presented clearly in tables that allow educators, students, and families to clearly see the learning progressions of each standard across grades (with the exception of the "banded" high school grades). Expectations for students are also clearly articulated and specific.

## – Clarity & Specificity Weaknesses

In places, however, the reading and writing standards are worryingly vague. For example, while the standards require students to read increasingly challenging literary and informational texts as they progress from grade to grade, and read closely and independently for a "sustained period" of time, it is unclear how educators should measure or gauge mastery of such expectations. Additionally, as mentioned, more detail is needed regarding writing expectations and how these should progress and build in rigor over time.

# Recommendations

1. Establish clear distinctions in expectations across all grade levels, including adding explanatory details in the standards as appropriate.
2. Create grade-specific English language arts standards for high school to clarify expectations at each grade level and eliminate duplication across grades.
3. Develop discipline-specific literacy standards for grades 6–12 to communicate expectations for use outside of the English classroom.
4. Directly reference or link to text complexity guidance within the standards.
5. Include expectations for genres/subgenres and literary elements that should be mastered in the literature standards.
6. Designate specific literary and informational texts at all grade levels with which students should be familiar (or at minimum, provide exemplar texts for teacher consideration).

## Bottom Line

Targeted revisions recommended along with a focus on implementation of these standards.

## Documents Reviewed

North Carolina Standard Course of Study for English Language Arts for Implementation 2018–2019 (adopted April 2017), accessed from http://www.ncpublicschools.org/docs/curriculum/languagearts/scos/adopted-ela-standards.pdf.

## Endnotes

1. In January 2018, the state published additional resources to guide and inform implementation of the standards. These resources include information on academic vocabulary and text complexity expectations, and other tools such as professional development kits and graphic organizers to support instruction. These resources were not included in the present review, as they were not available at the time. They are now available online at http://www.livebinders.com/play/play/297779.

English Language Arts

# Oklahoma

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1

**Strong**

*Recommend focus on the implementation of these standards.*

**Good**

***Targeted revisions recommended along with a focus on implementation of these standards.***

**Weak**

*Significant revisions recommended. Standards should not be implemented until and unless these revisions are made.*

**Inadequate**

*Complete revision highly recommended. Standards have critical shortcomings and should not be implemented.*

## Overall Rating: Good (7/10)

Content & Rigor (4/7) + Clarity & Specificity (3/3)

## Overview

The Oklahoma English Language Arts (ELA) Standards are exemplary for their organization and breadth. The standards document is clearly organized, includes explicit attention to expectations for student learning, and delineates key concepts in each standard. Each standard is organized with a focus on reading and writing from pre-K through twelfth grade "to support integrated, rather than isolated, reading/ writing instruction." The standards are also accompanied by substantial resources that support their implementation, including a glossary, information on text complexity, and research used in developing the standards.

Despite these strengths, however, Oklahoma's standards are lacking in several areas. While the importance of reading and writing within a discipline is emphasized, there is no mention of disciplinary literacy, which is critical for students to develop the skills needed to read history, social studies, science, and other technical texts. In addition, various writing genres, such as argument and narrative writing, receive more emphasis than others, and the standards lack expectations for writing in other genres and for the length of writing assignments. Finally, in places, the standards lack the specificity needed to implement them—for example, by not defining "grade-appropriate words" (2.2.W.3, 3.2.W.3, 4.2.W.3).[1]

# General Organization

Oklahoma's ELA standards are prefaced by several helpful introductory and supplemental resources, such as guiding principles that facilitate understanding of the standards and an explanation of how clarity and coherence were developed across them. The document outlines four clear purposes for the standards. They expect students: 1) to "hear the voices of their own heritage in the literature they encounter"; 2) "to become independent readers in a range of disciplines" (though, as noted above, these are not further defined); 3) "to become independent writers for a variety of audiences and a range of purposes"; and 4) to possess "the skills required to analyze, evaluate, act upon, and compose a wide range of communications."

Individual grade-level standards are defined for pre-K–12, and the standards are organized vertically so that a reader can see how expectations for each standard progress across the grades. Expectations are organized around eight overarching categories: Speaking and Listening; Reading Foundations/Reading Process and Writing Process; Critical Reading and Writing; Vocabulary; Language; Research; Multimodal Literacies; and Independent Reading and Writing.

Within each standard there is an iterative focus on reading and writing, and the grade-level standards also show how listening and speaking fit within these expectations. For instance, in the grade 11 Speaking and Listening standards, students are expected to effectively communicate about the texts they are reading (11.1.R.3). In grade 9, students are expected to engage in discussions about text, expressing their ideas built from the text content (9.1.R.3).

# Content & Rigor

## + Content & Rigor Strengths

Oklahoma's ELA standards have several notable strengths. First, they include a specific focus on vocabulary, language, research, multimodal literacies, and independent reading and writing, as opposed to subsuming them within broader standards. Separating the expectations provides educators with more clarity on each one

Second, the expectations in reading and writing clearly build from one grade to another. For instance, in kindergarten students are expected to "engage in collaborative discussions about appropriate topics and texts with peers and adults in small and large groups with guidance and support" (K.1.R.3). In first grade, these expectations are mirrored—but without guidance and support from a teacher (1.1.R.3). These learning progressions signal how the standards develop over time. The standards also outline detailed pre-K foundational skills, which are well-aligned to Oklahoma's K–12 standards. For example, students are expected to "distinguish spoken words in a sentence" (PK.2.PA.1) and "recognize spoken words that rhyme" (PK.2.PA.2).

Another strength is the conscientious pairing of reading and writing within each standard. For instance, in the standard that centers on reading and writing processes, second-grade students are expected to "locate the main idea and supporting details of a text" in reading and to "develop drafts by sequencing the action or details in a story or about a topic through writing sentences" (2.2.R.1, 2.2 W.1). Through this integration, students move from recognizing details in reading to actualizing these details in their own writing.

As this example demonstrates, the standards also focus on learning outcomes, rather than learning processes (even in Standard 2, where reading and writing *processes* are the explicit focus). This approach, which is consistent throughout the standards, keeps the emphasis on measurable student learning outcomes rather than processes or activities.

Finally, the standards underscore the importance of students working "effectively and respectfully with diverse groups" (4.1.W.2–10.1.W.2). In this standard, students are expected to "share responsibility for collaborative work" and "value individual contributions made by each group member." This ability to accommodate and appreciate the ideas and opinions of others prepares students to work well with others at the post-secondary level and in their future careers.

## − Content & Rigor Weaknesses

Several key weaknesses undermine Oklahoma's ELA standards. First, there is no mention of disciplinary literacy, which is critical for students to develop the skills needed to read and write in disciplines such as history, social studies, science, and mathematics.

Second, the critical reading and writing standards are unclear relative to what constitutes grade-level literary and/or informational text. Although teachers can refer to general Lexile levels outlined in the document to make

this determination, these present ranges of text difficulty, rather than more precise text examples. For instance, fourth-grade students are expected to read grade-level texts with fluency (4.2.F.2). Yet the suggested Lexile levels are broad, ranging from 445 to 810, which does not offer teachers much clarity about what constitutes "grade-level." And while the standards include clear language about the importance of taking quantitative, qualitative, task, and reader considerations into account when measuring text complexity, the document only provides guidance on quantitative measures. As a result, teachers must use their discretion to select texts of appropriate difficulty.

This ambiguity is further compounded by the fact that there are no exemplars provided to help teachers select appropriately rigorous texts. For example, the standards expect students to read and respond to a variety of "complex texts of all literary and informational genres from a variety of historical, cultural, ethnic, and global perspectives" (Standard 3: Reading Strand), but provide no exemplars to help teachers enact this standard.

The standards are also insufficiently specific as to the genres and subgenres that students need to master. For example, by the end of third grade, students should have had experience reading informational text; fiction; nonfiction; poetry; drama; nursery rhymes; fables, folk, fairy and tall tales; and autobiography and biography. These are vague recommendations and would be improved by offering examples of texts.

Finally, various writing genres, such as argument and narrative writing, are emphasized more than others, and the standards lack expectations for writing in other genres and for the length of writing assignments.

# Clarity & Specificity

## + Clarity & Specificity Strengths

For the most part, the standards are jargon-free and easily accessible to a variety of audiences. The introductory materials clearly explain the purpose of the standards. Technical vocabulary, such as reading fluency or phonological awareness, is explained multiple times (e.g., in the introduction, within the standard, and in the glossary). The standards document also provides a table delineating text complexity expectations in various career areas; although as noted previously, this document is focused on quantitative measures of text complexity.

In addition, eight overarching College- and Career-Readiness (CCR) standards for reading and writing help users "identify the knowledge and skills of the discipline that PK–12 students are to learn." These are explicit, specific, and measurable. For example, Writing Standard 6 requires students to "summarize and paraphrase, integrate evidence, and cite sources to create reports, projects, papers, texts, and presentations for multiple purposes." Overall, the standards furnish a clear signal to educators, community members, and textbook writers about what Oklahoma's students need to be prepared for post-secondary education and the workforce.

## – Clarity & Specificity Weaknesses

Despite the standards' overall clear organization, there are a few areas where additional detail is needed to improve clarity. As mentioned previously, the standards offer insufficient guidance regarding text complexity, exemplars, and genres and subgenres. In other places, language is vague. For example, under the Reading and Writing Process standard, teachers are expected to support students in writing "grade-appropriate" words in grades 2–4, but there is no mention of what words would be considered appropriate. In the Vocabulary standard, "domain-appropriate" vocabulary is mentioned in the reading and writing strands without an explanation of what it means.

A final concern is vagueness of writing expectations. For example, students in grades 5 and 8 are expected to create multimodal content (audio, video, print mediums), yet no difference in writing products or outcomes is clarified (for example, see 5.7.W.1, 8.7.W.1). Similarly, in grades 8 and 11, students are expected to complete a report, but the relevant standards provide no specifics regarding how these reports should differ from one another. Strong standards clearly illustrate the growth expected across grades. Conversely, vague, redundant expectations across grades fail to advance skills and knowledge.

# Recommendations

1. Develop discipline-specific literacy standards for grades 6–12 to communicate expectations for use outside of the English classroom.
2. Provide more detail and specificity around grade-level expectations, and how these vary from grade to grade.
3. Establish text complexity requirements that specify particular text complexity levels that students should be able to read at the various grade levels.
4. Designate specific literary and informational texts at all grade levels with which students should be familiar (or at minimum, provide exemplar texts for teacher consideration).
5. Include expectations for genres/subgenres and literary elements that should be mastered in the literature standards.

## Bottom Line

Targeted revisions recommended along with a focus on implementation of these standards.

## Documents Reviewed

Oklahoma Academic Standards: English Language Arts (2016), accessed from http://sde.ok.gov/sde/sites/ok.gov.sde/files/documents/files/OAS-ELA-Final%20Version_0.pdf.

## Endnotes

1. For another take on Oklahoma's standards, please see https://www.achieve.org/files/AchieveReviewofOklahomaStandards-03-18-16.pdf and https://www.achieve.org/strong-standards.

English Language Arts

# Pennsylvania

10 9 **Strong**

*Recommend focus on the implementation of these standards.*

8 7 **Good**

***Targeted revisions recommended along with a focus on implementation of these standards.***

6 5 **Weak**

*Significant revisions recommended. Standards should not be implemented until and unless these revisions are made.*

4 3 2 1 **Inadequate**

*Complete revision highly recommended. Standards have critical shortcomings and should not be implemented.*

## Overall Rating: Good (7/10)

Content & Rigor (4/7) + Clarity & Specificity (3/3)

## Overview

The Pennsylvania Core Standards for English Language Arts (ELA) have several strengths. They're well written and clearly organized. Vocabulary and language standards are embedded into reading and writing standards and are internally aligned to learning progressions across the grades. This is a strength as these should be taught within the context of reading and writing, and not as separate content. The prekindergarten (pre-K) additions are an important step in advancing early childhood education in the Commonwealth. The standards also pay significant attention to disciplinary literacies, oral language, and writing.

Still, several weaknesses undermine these otherwise solid standards, including vague language about text complexity and the ambiguous direction to use "grade-level" texts. (Directions about text complexity appear in an appendix but are not referenced in the standards themselves.) The standards also lack grade-specific standards at the high-school level and specific college- and career-readiness standards, providing no overall target to prepare graduates for post-secondary success.

## General Organization

Pennsylvania's Core Standards for English Language Arts are presented in two documents, one for K–5 and one for grades 6–12. They are further divided into five major domains: Foundational Skills (pre-K–5), Reading Informational Text, Reading Literature, Writing, and Speaking and Listening. These are accompanied by additional standards for subjects in grades 6–12: Reading and Writing in History and Social Studies, and Reading and Writing in Science and Technical Subjects.

The standards are supported by the three original appendices published by the CCSSO in 2010, and are located on the standards website:

- *Appendix A: Research Supporting Key Elements of the Standards and Glossary of Terms*
- *Appendix B: Text Exemplars and Sample Performance Tasks*
- *Appendix C: Samples of Student Writing*

Individual grade-level standards are defined for K–8. In high school, standards are reported in two-year bands (9–10 and 11–12.) The Pennsylvania ELA standards are articulated both vertically and horizontally (across and within grade levels) to show a learning progression.

# Content & Rigor

## Content & Rigor Strengths

Pennsylvania's ELA standards are largely free from redundancies, generally measurable, and have several notable strengths. First, the Foundational Skills standards are logical and coherent, and developmentally appropriate. For example, argumentation in writing begins in sixth grade, developmentally consistent with young adolescents' growing ability to think in more abstract ways, using formal reasoning.

Second, specific standards are devoted to the reading of informational texts and literature. These standards parallel one another, meaning that they are clustered in the same order (key ideas and details, followed by craft and structure). This contributes to coherence as teachers can see similarities across text types. Importantly, specific differences between reading literature and reading informational texts are contrasted (e.g., identifying the elements of story in literature is different from identifying the author's premises, reasoning, purposes, and audiences in informational texts.)

A third strength lies within the Writing standards. They clearly emphasize producing different types of text, for different purposes and audiences. There are specific standards at each grade level dedicated to four types of text: Informative/Explanatory, Opinion/Argumentative, Narrative, and Response to Literature. Students are directed to consider audience and purpose. For instance, within the Narrative writing standards, sixth-grade students are directed to "engage and orient the reader by establishing a context and introducing a narrator and/or characters" (CC.1.4.6.N). Within the Informative/Explanatory writing standards, these same students are required to "develop and analyze the topic with relevant facts, definitions, concrete details, quotations, or other information and examples; include graphics and multimedia when useful to aiding comprehension" (CC.1.4.6.C). These standards provide clear and nuanced guidelines about the differences in writing for these purposes.

Also praiseworthy is the attention devoted to disciplinary literacies, such as science, history/social studies, and technical subjects. These standards are detailed and send an important message to secondary content educators that attention to reading and writing is essential in the mastery of subject area standards.

## Content & Rigor Weaknesses

Four main weaknesses undermine the quality and rigor of Pennsylvania's ELA standards: spotty application of text complexity, a lack of specific content expectations for genres and subgenres, the absence of college- and career-readiness standards, and a lack of grade-specific standards for high school.

First, the standards do a poor job of defining text complexity, which should define specific rigorous text expectations for educators and students. Appearing on the state's website is CCSSO's 2010 *Appendix A* on text complexity, which contains extensive information about the quantitative, qualitative, and reader and task considerations necessary to evaluate appropriate texts. Yet the main standards document does not reference this resource directly, and shies away from explicitly outlining rigorous and quantifiable reading expectations. For example, the Range of Reading standards for Informational Text and Literature are exactly the same from grades 1–12: "Read and comprehend [literary nonfiction, informational text, literature] on grade level, reading independently and proficiently." But they don't provide additional information about what constitutes "on grade level," leaving educators to make this determination—and running the risk of lowering expectations. This puts Pennsylvania students at risk for educational inequities, as some students will not be taught with regard to uniformly high expectations.

A second weakness is the lack of specific content expectations pertaining to genres and subgenres, and specific works and texts. There are a few references to specific genres (e.g., literary and informational) but they are lumped together. For example, see CC.1.3.7.G: "Compare and contrast a written story, drama, or poem to its audio, filmed, staged, or multimedia version…" as well as CC.1.3.5.G: "Analyze how visual and multimedia elements contribute to the meaning, tone, or beauty of a text (e.g., graphic novel, multimedia presentation of fiction, folktale, myth, poem)." Genres appear as a jumble, rather than for specific purpose, and seem to be there for the sake of novelty rather than mastery. In fact, this is the only instance in the K–5 standards where any mention of genres is made, suggesting that the other standards can be fully met within a constrained set of genres, such as contemporary fiction. This is problematic; it is essential that students are able to read across historical periods and cultures in order to deepen comprehension, vocabulary, and knowledge. A few genres are mentioned in passing in the grades 6–12 standards, but only in the broadest of terms ("a modern work of fiction," "foundational works of literature," "foundational U.S. and world documents," "seminal texts"). The standards do not reference *Appendix B*, which provides text exemplars across a range of genres, as a source for further guidance.

In addition, at no time are students directed to engage with specific works and titles, and no reading list accompanies the standards. For example, while "foundational" works are noted as important, there is no example of what such works (or documents) comprise. Only in grades 11–12 is there any specificity—e.g., "at least one play by Shakespeare" (CC.1.3.11–12.G). This lack of reading exemplars further magnifies the standards' lack of direction about genres and subgenres. Nothing in the standards suggests the breadth of texts that should be read and analyzed, such as satire, essays, or speeches.

A third weakness is in the omission of college- and career-readiness (CCR) standards. While the standards' brief front matter says that there is "a focus on college- and career-readiness," no such standards are explicitly stated. CCR standards anchor grade level standards by stating the final outcome expectations for high school graduates. The grade-specific standards should build toward them. The absence of explicitly stated college- and career-readiness standards means that there is no focus on systematically developing the skills and knowledge needed for post-secondary success.

Finally, grade-specific standards are not articulated for high school, resulting in redundancy in expectations across grade spans. For example, reading and writing standards are identical for ninth and tenth graders. As a result, it is unclear how expectations are to advance from grade to grade.

Taken together, the inconsistent expectations about text complexity, the lack of direction about genres and specific works of merit, and the absence of college- and career-readiness standards and grade-specific standards in high school are the most significant places where Pennsylvania's standards could be strengthened.

# Clarity & Specificity

## + Clarity & Specificity Strengths

The language used to articulate Pennsylvania's ELA learning progressions across grades is thoughtful and aligned with current research and developmental expectations. These progressions importantly signal to educators, students, and textbook writers how each grade builds upon the previous one. The individual standards are observable, measurable, and provide detailed information about the stated expectation. This level of specificity should aid test developers in creating sound assessment items. The organizational structure and presentation of the standards is easy for users, and largely free from jargon. A glossary is available to further define terms.

## – Clarity & Specificity Weaknesses

While the learning progressions are carefully conceived, logical, and instructive, minor organizational items could be made clearer by reformatting. Namely, redundancies in the Writing standards could be further streamlined, such as collapsing the conventions and styles standards into one (CC.1.4.F/L/R and CC.1.4.E/K/Q). The requirement to use correct capitalization, punctuation, and conventions does not vary significantly across text types (Informative/Explanatory, Opinion/Argumentation, or Narrative) and as such need not be restated each time. Finally, cross-referencing or otherwise internally referring to supporting documents that currently appear as appendices—particularly those that address text complexity and provide a glossary of terms—would further strengthen clarity. These appendices contain valuable information, but can easily be overlooked by educators and textbook writers.

# Recommendations

1. Design college- and career-readiness standards to anchor learning progressions from pre-K–12.
2. Create grade-specific English language arts standards for high school to clarify expectations at each grade level and eliminate duplication across grades.
3. Replace vague and ambiguous statements of "grade-level" or "on-level" texts with explicit expectations for text complexity.
4. Directly reference or link to text complexity guidance within the standards.
5. Include expectations for genres/subgenres and literary elements that should be mastered in the literature standards.
6. Designate specific literary and informational texts at all grade levels with which students should be familiar (or at minimum, provide exemplar texts for teacher consideration).
7. Eliminate redundancies in the writing standards and internally reference supporting documents to promote clarity.

## Bottom Line

Targeted revisions recommended along with a focus on implementation of these standards.

## Documents Reviewed

Pennsylvania Core Standards in English Language Arts (2014), accessed from http://www.pdesas.org/Standard/PACore.

English Language Arts

# South Carolina

10
9
**Strong**
*Recommend focus on the implementation of these standards.*

8
7
**Good**
*Targeted revisions recommended along with a focus on implementation of these standards.*

6
5
**Weak**
***Significant revisions recommended. Standards should not be implemented until and unless these revisions are made.***

4
3
2
1
**Inadequate**
*Complete revision highly recommended. Standards have critical shortcomings and should not be implemented.*

## Overall Rating: Weak (6/10)

Content & Rigor (4/7) + Clarity & Specificity (2/3)

## Overview

The South Carolina College- and Career-Ready Standards for English Language Arts were adopted in 2015. They are generally clearly written and measurable, and have several content strengths, including extending expectations of literacy development in areas of fluency and handwriting. Unfortunately, the standards offer insufficient guidance on text complexity and disciplinary literacy, and lack examples of rigorous texts. In addition, in places, the knowledge and skills standards articulated for each grade remain the same for three or even four consecutive years, meaning that there is no expectation of growth for long periods of time. At the time of review, critical supporting documents that were promised three years ago have also not yet been delivered, which leaves educators and curriculum developers unclear as to the kinds of materials South Carolina students should be reading, writing about, and discussing.

## General Organization

The standards open with an explanation of the state's adoption process and a rationale for their format and content and are generally well organized and easy to follow. Several versions of the standards are available: by grade level, by grade bands (K–2, 3–5, 6–8, and 9–12), and a vertical articulation, so that educators see the progress across grades K–12. Unfortunately, some standards show no progression at all for multiple years. Standards for grades K–8 are presented for each grade level, while the standards for high school are aligned to specific courses (English I–IV), rather than by grade, which is an unusual organizational method for high school ELA standards.

The standards are organized into five strands: Inquiry-Based Literacy; Reading-Literary Text; Reading-Informational Text; Writing; and Communication. The standards are also accompanied by five college- and career-readiness standards (CCR), which South Carolina calls "Inquiry-Based Literacy Standards," anchored to each grade level standard, which articulate what high school graduates should know and be able to do as they move into post-secondary studies or the world of work. Although the front matter promises that supporting documents will be developed, including "a glossary, vertical articulation documents, Depth of Knowledge (DOK) and Bloom's levels, and a correlation/crosswalk document," at the time of the review, only one of those (addressing vertical articulation) was currently available. Other supporting documents promised elsewhere in the standards are also unavailable on the website, and include information on disciplinary literacy, inquiry-based literacy, and fundamentals of reading, writing, and communication.

# Content & Rigor

## + Content & Rigor Strengths

South Carolina's ELA standards provide clear expectations in several noteworthy areas, beginning with a largely successful attempt to present a coherent vision of literacy development. For instance, principles of reading—which include phonemic awareness, concepts of print, and phonics—are presented as early essential skills that are woven into reading comprehension. In other words, they are not viewed as entirely separate from the act of reading itself, but are rightly seen as crucial early indicators.

Also strong is the presentation of vocabulary growth within the context of Language, Craft, and Structure. Vocabulary is correctly viewed not as the acquisition of words and phrases in their own right, but rather as a vital facet of reading comprehension. For example, first graders are already exploring "word relationships and nuances in word meaning" (1.RI.10.5), not just learning definitions. Similarly, mastery of language conventions is cast within the context of the writing standards. Examples include the expectation that kindergartners use spaces between words, third-grade students consult print and multimedia sources to check and correct spelling, and fifth-grade students correctly capitalize.

Other strengths include a longer view of fluency expectations through twelfth grade. While many states end fluency expectations around fifth grade, South Carolina standards wisely recognize that fluency norms typically extend through eighth grade, and are impacted by the complexity of the text itself. Even in high school English courses, students are expected to "read grade-level prose and poetry orally with accuracy, appropriate rate, expression, intonation, and phrasing on successive readings" (E1.RL.4.2–E4.RL.4.2).

Another notable strength is the addition of a handwriting and cursive standard for elementary students, which aligns well with keyboarding expectations for developing digital texts. Therefore, second-grade students "begin to develop efficient keyboarding skills" (2.W.6.4) at the same time they are expected to "begin to develop cursive writing" (2.W.6.5).

Finally, South Carolina identifies genres and subgenres of literature and informational text at all grade levels. These range from odes and epic poems to speeches, contracts, and government documents. The inclusion of specific genres and subgenres communicates an expectation to teachers, students, and other stakeholders that instruction must include a rich array of text types.

## − Content & Rigor Weaknesses

Several important omissions undermine South Carolina's ELA standards. Chief among them is a lack of any definition whatsoever of text complexity. While students are expected to read "grade-level texts," as noted in Range and Complexity standard 13.3, there is no information about what quantitatively and qualitatively makes for such a text. Nor are South Carolina educators assisted by text exemplars, as these are also lacking.

Exacerbating these deficiencies, the standards do not specify any foundational texts or documents from literature or letters that students are to read and know, meaning that some students are likely to go through their schooling without a deep exploration of canonical texts or foundational documents. The result of these omissions is that text selections become local decisions, meaning that a "grade-level text" in one school or district may be vastly different from one read and discussed in another. The median reading level of a classroom therefore becomes the yardstick that educators typically use to select texts, which is an inherently inequitable system that perpetuates differing opportunities to learn for children and adolescents.

Second, the state's disciplinary literacy standards, which describe how literacies are utilized in subject areas such as science, history, and technical subjects, are not actually standards. Instead, they simply include a bulleted list of three vague and general practices that are exactly the same from kindergarten through twelfth grade. For example, students are expected to "determine appropriate disciplinary tools" in inquiry (I.4.2)—but these are never specified. Similarly, there is no mention of discipline-specific writing at all beyond the three text types of argument, informative/explanatory, and narrative writing.

Third, learning progressions are problematic in several places within the standards. One should be able to read the standards across grade levels to see the incremental growth of knowledge and skills expected. However, there are places where the standards remain the same for multiple years. Chief among these are Inquiry-Based Literacy standards that do not change within grade bands (K–2, 3–5, 6–8, 9–12). For example, in Inquiry-Based Literacy standards for grades 3–5, the same standard repeats for each grade: "Formulate questions to focus thinking on an idea to narrow and direct further inquiry" (I.1.1). The same issue holds for Writing for text types in grades 6–8, as well as in the aforementioned Disciplinary Literacy grade band practices. Presumably these should change based on increasing text complexity and production. However, the lack of grade-specific learning progressions undermines the value of the K–12 Inquiry-Based standards, and the grades 6–12 Writing standards.

Finally, while the state's Inquiry-Based Literacy standards spotlight the vital nature of using digital and print texts, they lack specific expectations for use in investigation and research. While it is commendable to emphasize inquiry as a reason for engaging in reading, writing, and communication, the majority of these standards focus on processes, such as metacognition, rather than on measurable learning outcomes. For instance, it is impossible to determine whether a student "employ[s] past learning to monitor and assess current learning to guide inquiry" (3.I.5.2–5.I.5.2). Further, the document confusingly states that these standards "work in concert with Disciplinary Literacy and should be viewed as a system." Unfortunately, as noted previously, there are no disciplinary literacy standards, only a list of three practices.

# Clarity & Specificity

## + Clarity & Specificity Strengths

The standards are jargon-free and stated clearly. Aside from the inquiry-based literacy standards, most standards are measurable, with an overall focus on learning outcomes more than on process. The standards are also helpfully presented in several forms: by grade level, by grade bands (K–2, 3–5, 6–8, and 9–12), and vertically, so that educators can view complete learning progressions across several grade levels to see how expectations change. These are further linked to broad CCR anchor standards at each grade level to keep the focus on outcomes for graduates.

## – Clarity & Specificity Weaknesses

The standards are unnecessarily repetitive in places. For example, every standard is presented through twelfth grade, even when the standard has long since been mastered. This occurs specifically in the Principles of Reading foundational skills, which students should have mastered a decade earlier. For instance, it is unnecessary to mention that high school students should have mastered the ability to "recognize the distinguishing features of a sentence" in first grade (E1.P.1.1). This repetition is likely to be cumbersome and confusing to educators and parents alike.

More concerning, the standards do not include sufficient guidance to help educators, curriculum developers, and test developers select texts. For example, there is no information provided on quantitative and qualitative expectations of text complexity, which should guide how materials are selected. The lack of promised supporting documents three years after the adoption of these standards is deeply troubling.

# Recommendations

1. Identify and revise standards that remain unchanged for two or more years to more clearly articulate how learning progresses from one grade level to the next.
2. Establish text complexity requirements that specify particular text complexity levels that students should be able to read at the various grade levels.
3. Revise Inquiry-Based Literacy standards into requirements that can be taught and measured. Eliminate standards that are only process-oriented.
4. Develop discipline-specific literacy standards for grades 6–12 to communicate expectations for use outside of the English classroom.
5. Designate specific literary and informational texts at all grade levels with which students should be familiar (or at minimum, provide exemplar texts for teacher consideration).
6. Complete the supporting documents that were promised in 2015. These are needed to provide specific guidance to educators. Particularly urgent is information on depth of knowledge, disciplinary literacy, foundational skills, as well as a glossary.

## Bottom Line

Significant revisions recommended. Standards should not be implemented until and unless these revisions are made.

## Documents Reviewed

South Carolina College- and Career-Ready Standards for English, accessed from https://ed.sc.gov/instruction/standards-learning/english-language-arts/standards/.

English Language Arts

# Tennessee

10
9
**Strong**
*Recommend focus on the implementation of these standards.*

8
7
**Good**
*Targeted revisions recommended along with a focus on implementation of these standards.*

6
5
**Weak**
***Significant revisions recommended. Standards should not be implemented until and unless these revisions are made.***

4
3
2
1
**Inadequate**
*Complete revision highly recommended. Standards have critical shortcomings and should not be implemented.*

## Overall Rating: Weak (5/10)

Content & Rigor (4/7) + Clarity & Specificity (1/3)

## Overview

Tennessee's English Language Arts (ELA) standards fall short in both content and rigor as well as organization and clarity. In many places, the standards are vague and do not provide sufficiently clear direction to educators, families, and students. There are multiple points of redundancy in the document where standards overlap with standards for previous grade levels (most notably in their treatment of vocabulary). The level of rigor is often not well articulated, or is inappropriately challenging, as is the case with many of the kindergarten standards. In addition, there is no mention of disciplinary literacy and no formal integration of technology within the standards.

Still, there are a few notable strengths, including reading standards that establish a clear connection between literature and informational text expectations, and writing standards that include specific expectations at each grade level. The standards are fairly well organized, plus their vertical formatting helps readers understand their progression across grade levels.

## General Organization

The Tennessee Academic Standards in English Language Arts are organized vertically so readers can see the expectations for each standard from K–12 in a single table, rather than separately by grade. The standards are also clustered into grade level bands: K–5, which focuses on foundational skills; grades 6–8, which focuses on solidifying foundational skills while increasing complexity of text selection and tasks; and grades 9–12, "where sophistication and style" are expected. (Unfortunately the latter is not defined!)

Individual grade-level standards are defined for K–8. In high school, standards are reported in two-year bands (9–10 and 11–12.) There are five strands within the standards:

1. Foundational K–5 Literacy
2. Reading
3. Speaking/Listening
4. Writing
5. Language 6–12

The content of the standards is focused at the strand level. For example, in the Foundational K–5 Literacy Skills strand, standard 1 centers on print concepts, with accompanying expectations for kindergarten and first-grade students, such as understanding the features of a sentence and the organization and basic features of print (respectively). There are multiple standards under each strand, including seven under Foundational Skills: print concepts, phonological awareness, phonics and word recognition, word composition, fluency, sentence composition, and vocabulary acquisition.

A general introduction precedes the entire standards document and brief introductions frame each section. Three appendices also accompany the standards: a glossary, references supporting the standards, and a framework for how to gauge text complexity. The writers use a masonry metaphor wherein "cornerstone" and "keystone" references appear throughout. For example, the keystone of the standards is the ultimate goal of graduating students who are prepared for post-secondary and career opportunities; cornerstone standards comprise the foundation that supports that goal. Similarly, the standards were designed to build on each other in successive grades (for example, they begin with foundational literacy standards that increase in complexity over time).

# Content & Rigor

## + Content & Rigor Strengths

The standards have several commendable content strengths. The reading standards clearly articulate what is expected for readers to be college- and career-ready, such as the ability to read complex texts and bolster their position through the use of evidence. A helpful introductory guide describes the percentages of literary and informational texts used within elementary, middle, and high school English classrooms (a 50/50 balance in elementary classrooms, developing to more specified uses of informational texts, especially related to research and argument by high school).

The reading standards also establish consistent expectations for both literary and informational texts. For example, one Reading strand cornerstone expects students to "determine central ideas or themes of a text and analyze their development" for a literary or informational text (R.KID.2). While this standard is detailed for each grade level, expectations increase over time. For instance, in first grade, students are expected to retell stories or identify the main topic in informational text. By sixth grade, students are expected to determine the theme in literary texts and identify a central idea with supporting details in informational texts.

The writing standards also set clear and specific expectations for each grade level. For example, there are nine specifications for writing an argument with supporting evidence in grade 8 (8.W.TTP.1): introduce a claim; support the claim with evidence; organize reasons and evidence; use credible sources; craft an effective conclusion; use precise language; use appropriate transitions; use varied sentence formats; and maintain a formal style. Further, the writing standards require students to produce different types of texts, such as argumentative, informative/explanatory, and narrative, and to use technology to strengthen writing, conduct research projects and use evidence as support. In this way, the writing standards are primarily focused on production (not process) and on measurable student outcomes.

## – Content & Rigor Weaknesses

Tennessee's standards have several important weaknesses and omissions. These include vague language and murky student expectations, a lack of increasing levels of difficulty in standards across grades, unusually high expectations for the early grades, little guidance about how to determine text complexity, lack of clarity around technology, and the omission of disciplinary literacy standards in the secondary grades. We'll take each of these briefly in turn.

The paucity of illustrative examples combined with vague language makes many of Tennessee's standards difficult to implement. For instance, in the Language Standards, one grade 11–12 standard states, Students will "consider complex and contested matters of usage and convention" (11–12.L.CSE.1). However, there are no examples to clarify what that means.

The Writing standards also lack clear expectations for producing research (W.RBPK.7) and for increased rigor in research production. For instance, in grades 2–8, students are expected, sans particulars, to answer a question through a research activity: "Conduct research to answer a question, drawing on multiple sources and refocusing the inquiry when appropriate" (6.W.RBPK.7). And in grades 9–12, students are expected to conduct a research project. Yet no information is provided about the difference in expectations across grades, for instance, relative to the length and presentation of the results, other than to say students should conduct "short as well as more sustained" projects (9–10.W.RBPK.7, 11–12.W.RBPK.7).

The Language standards for grades 6–12 are often redundant and fail to increase competence and rigor across grade levels. For instance, in Standard 4, each grade level has exactly the same outcome expected of students. For sixth grade, the standard reads as follows:

> *Determine or clarify the meaning of unknown and multiple-meaning words and phrases based on 6th grade-level text by choosing flexibly from a range of strategies: a. Use context as a clue to the meaning of a word or a phrase; b. Use common grade-appropriate morphological elements as clues to the meaning of a word or a phrase; c. Consult reference materials, both print and digital, to find the pronunciation of a word or phrase; [and] d. Use etymological patterns in spelling as clues to the meaning of a word or phrase (6.L.VAU.4).*

The only change from grades 6–12 is the mention of grade level, and this repetitive pattern is repeated for Language Standards 5 and 6, which relate to vocabulary acquisition and use of language. Grade-specific standards are also not articulated for high school, resulting in redundancy in expectations across grade spans. As a result, it is unclear how expectations are to advance from grade to grade.

In other places, the standards are overly demanding. For example, kindergarten students are expected to be independent readers and writers by the end of the year, an unusually ambitious goal that's not realistic for many five- and six-year-olds. Specifically, they should read with "sufficient accuracy and fluency to support comprehension" (K.FFL.F.5) and spell and decode three-phoneme (CVC) words (K.FFL.PWR.3.d, K.FFL.WC.4.d). These expectations are typically targeted to first graders; most kindergarteners do not yet demonstrate fluency in their reading since they still read word-by-word. (Children in kindergarten are typically expected to understand the differences in phoneme, or final sound, representation in short and long vowel words and correctly spell three-phoneme words.)

Moreover, while there is information about text complexity included in *Appendix A*, there are no text exemplars to support text selection in any grade. This omission handicaps primary educators in particular, as the quantitative and qualitative measures are not included for kindergarten or first grade. As a result, what qualifies as "on grade level" is left to individual teachers' discretion. (For other grade levels, there are indicators for grade-level reading, although often grades are combined into bands; these make it more difficult for teachers to select appropriate reading material for each grade.)

The inclusion of technology is also problematic; by design, standards writers left technology standards "open to the ever-changing environment." As such, the standards only include limited suggestions for technology integration, and do not identify or call for students to know and use specific types. The Speaking and Listening standards, for instance, expect that students integrate information from diverse media formats, but provide no further information about what these might be. Similarly, in one third-grade standard for speaking and listening (3.SL.CC.2), a description of diverse media is offered where visual, quantitative, and oral formats are used as examples, but this description does not include screen media. Teachers will likely have difficulty instructing students with respect to technology with the standards as currently written.

Finally, the Reading standards lack any mention of reading expectations or disciplinary literacy for high school students outside of their English classes. This omission implies that students are not expected to engage in content-rich reading or broader literacy practices in science, math, or social studies classes. There is only a statement that "because secondary schools departmentalize by content area, the emphasis on reading informational text is divided across the specialized disciplines." However, no actual expectations for discipline-specific literacy are included. Moreover, there are no standards specifying that students need to develop the ability to read or write appropriately and effectively in the various disciplines. This omission disadvantages students, who aren't taught how literacy is a tool for acquiring and demonstrating knowledge and critical thinking across subject areas.

# Clarity & Specificity

## + Clarity & Specificity Strengths

For the most part, Tennessee's standards are fairly well organized and largely free of jargon. However, this is a qualified strength, as some instances of vague language appear in the standards but are defined in the glossary (e.g., common vowel teams, nonrestrictive elements). The glossary is helpful but it obviously relies on readers moving between both parts of the document.

In addition, the vertical formatting of the standards helps readers understand the progression of standards across grade levels. The introductions to each section offer important research to support the standards that follow, and blend older with more recent research. For instance, research by Tierney and Shanahan (1991) and Graham and Harris (2013) is shared for the writing standards. (Still, no distinction is made between research reports and professional development books, which is problematic.)

## − Clarity & Specificity Weaknesses

Unfortunately, the targeted grade-level audience is unclear in the Language K–12 standards. While labeled as such, only standards for grades 6–12 are included, yet the references in the research background for this section are often focused on young learners. Presumably, language standards are subsumed in the Foundational Literacy standards for grades K–5, but this relationship isn't as clear as it should be.

As noted previously, overall, the standards fail to communicate clear, measurable educational goals that increase in rigor by grade. The greatest concern is how multiple grade levels have the exact same expectations for several years, sometimes across the entire high school experience (see L.VAU.4). This is a major weakness that inhibits targeted and incremental development from one year to the next.

# Recommendations

1. Rewrite standards to eliminate redundancies in expectations across grades. Where appropriate, clarify different expectations at each grade level, and ensure clear progression in rigor from grade to grade.
2. Revise the Foundational Literacy standards targeted to kindergarten and make them more appropriate for kindergarten students.
3. Develop discipline-specific literacy standards for grades 6–12 to communicate expectations for use outside of the English classroom.
4. Provide text exemplars so that teachers have explicit examples of the text complexity expected at each grade, and add guidance around text selection for kindergarten and first grade.
5. Identify clear outcomes for research so that rigor can be increased across grade levels.
6. Incorporate clear technology expectations into the standards.
7. Clarify the targeted grade-level audience in the Language K–12 standards.
8. Create grade-specific English language arts standards for high school to clarify expectations at each grade level and eliminate duplication across grades.

## = Bottom Line

Significant revisions recommended. Standards should not be implemented until and unless these revisions are made.

## Documents Reviewed

Tennessee Academic Standards: English Language Arts (2017), accessed from https://www.tn.gov/education/instruction/academic-standards/english-language-arts-standards.html.

English Language Arts

# Texas

10 9 — **Strong**

*Recommend focus on the implementation of these standards.*

8 7 — **Good**

*Targeted revisions recommended along with a focus on implementation of these standards.*

6 5 — **Weak**

***Significant revisions recommended. Standards should not be implemented until and unless these revisions are made.***

4 3 2 1 — **Inadequate**

*Complete revision highly recommended. Standards have critical shortcomings and should not be implemented.*

## Overall Rating: Weak (6/10)

Content & Rigor (5/7) + Clarity & Specificity (1/3)

## Overview

The Texas Essential Knowledge and Skills for English Language Arts and Reading were adopted in May–June 2017. The revised K–8 standards are slated for implementation in the 2019–20 school year, and the high school standards in 2020–21. Overall, the content and rigor have some content strengths, but crucial omissions weaken their rigor. Notably, the standards do not have a text complexity definition or related expectations. In addition, there are no standards for disciplinary literacy or college- and career-readiness (CCR) outcome standards for Texas graduates. In their current form, the revised standards are difficult to access, which interferes with educators' attempts to understand and implement them. At the time of review, the standards also lack supporting documents that would provide further guidance to educators, students, families, and curriculum and test developers.[1] Completing and publishing robust supporting documents and materials might do much to improve the standards' clarity and specificity.

## General Organization

The Texas Essential Knowledge and Skills for English Language Arts and Reading (TEKS ELA) articulate standards for grades K–12. Standards for grades K–8 are presented for each grade level, while the standards for high school are aligned to specific courses (English I–IV), rather than by grade, which is an organizational method for ELA standards in high school.

While many state standards are organized according to the four major literacy modalities (reading, writing, speaking, and listening), the TEKS-ELA feature seven strands listed below that seek to integrate these domains:

1. Developing and sustaining foundational language skills: listening, speaking, discussion, and thinking—oral language. The student develops oral language through listening, speaking, and discussion.
2. Comprehension skills: listening, speaking, reading, writing, and thinking using multiple texts. The student uses metacognitive skills to both develop and deepen comprehension of increasingly complex texts.
3. Response skills: listening, speaking, reading, writing, and thinking using multiple texts. The student responds to an increasingly challenging variety of sources that are read, heard, or viewed.
4. Multiple genres: listening, speaking, reading, writing, and thinking using multiple texts—literary elements. The student recognizes and analyzes literary elements within and across increasingly complex traditional, contemporary, classical, and diverse literary texts.
5. Author's purpose and craft: listening, speaking, reading, writing, and thinking using multiple texts. The student uses critical inquiry to analyze the authors' choices and how they influence and communicate meaning within a variety of texts. The student analyzes and applies author's craft purposefully in order to develop his or her own products and performances.
6. Composition: listening, speaking, reading, writing, and thinking using multiple texts—writing process. The student uses the writing process recursively to compose multiple texts that are legible and uses appropriate conventions.
7. Inquiry and research: listening, speaking, reading, writing, and thinking using multiple texts. The student engages in both short-term and sustained recursive inquiry processes for a variety of purposes.

A vertical alignment chart of the standards is also available, showing how standards develop from grade to grade.

# Content & Rigor

## + Content & Rigor Strengths

The TEK-ELA standards are notable in several key areas. First, they admirably weave together the literacy domains of reading, writing, speaking, and viewing, which reflect the ways students learn. The foundational reading skills for young students progress in a logical manner, and include decoding, fluency, grammar, and spelling. The foundational skills of speaking and listening are especially strong and are thoughtfully articulated through grade-specific progressions.

The standards also require students in all grades to use evidence from texts to present their ideas and findings. In grades K–5, students are required to "use text evidence to support an appropriate response" (K.6.C–5.7.C). In grades 6–8, they "use evidence to support conclusions" and "reflect on and adjust responses as new evidence is presented" (6.6.I–8.6.I). In high school, they "provide evidence from the text using embedded quotations" (E1.15.C.ii–E2.15.C.ii).

This use of evidence is usefully counterbalanced with rhetorical and logical skills used in presentations and writing, and includes language concerning logical fallacies. This content will help to teach secondary students how to evaluate the credibility and quality of primary and secondary sources.

Vocabulary standards include expectations that middle school students master analogies and that high school students demonstrate the relationship between origins of terms from other languages (e.g., *coup d'état*) and their historical significance. In each case, the standards set expectations that students use formal reasoning and disciplinary knowledge to understand words and phrases.

Another strength of the standards speaks directly to the context of the state. The opening of each grade band (elementary, middle, and high school) directly addresses the needs of English learners and reminds readers that these students are on a continuum of success as they reach proficiency in English.

## Content & Rigor Weaknesses

Several critical omissions undermine these standards. Chief among these is vagueness around text complexity, literary genres and subgenres, and other "grade-level" expectations. The standards offer no guidance whatsoever about the quantitative and qualitative aspects of text complexity, or any explanation of what constitutes "grade-level texts." Without clear expectations concerning reading levels, educators are left to make decisions on their own that may be based on differing expectations of individual students—or students in different schools or communities—rather than high expectations for all. This is especially problematic in the second strand, Comprehension Skills, where there is virtually no variance in any standard from kindergarten through twelfth grade. For example:

- *Kindergarten states that students "establish purpose for reading assigned and self-selected texts with adult assistance" (K.7.A).*
- *English IV (grade 12) states that students "establish purpose for reading assigned and self-selected texts" (E4.4.A).*

This is compounded by the standards' lack of a *progression* of text complexity—meaning how texts are to build on one another in content and in rigor. The result is that Texas students will likely not be prepared for the type of texts they will encounter in college and in most careers.

This failure to show any progression in expectations is compounded by the thinness of detail concerning genres and subgenres. Although the fourth strand, Multiple Genres, should obviously be focused on multiple genres, it relies mostly on literary terminology (e.g., character traits, figurative language). Instead of requiring specific genres and genres, educators face either vague language or a long list of genres from which to choose. For example, the high school standards merely state that students should read "across literary periods" (e.g., E2.7.A). Conversely, educators in the lower grade levels are presented with a laundry list of genres squeezed into one standard preceded by the phrase "such as" (e.g., 6.8.A: "demonstrate knowledge of literary genres such as realistic fiction, adventure stories, historical fiction, mysteries, humor, and myths"). The phrase "such as" signals to educators that they can choose which genres to use (and ignore) rather than ensuring that all genres are given the attention they deserve. The standards also fail to outline specific literary works or foundational documents students should know (e.g., Declaration of Independence, Shakespeare). The absence of any exemplar texts or mandatory readings leave students vulnerable to reading only what is already familiar to or liked by a teacher. Reading across genres, subgenres, and foundational documents and canonical texts contributes to the critical knowledge-building element of the English language arts. These are significant shortcomings.

The standards are also uneven, with some comprised almost entirely of process and metacognitive skills, rather than measurable learning outcome standards. For example, the Comprehension Skills strand contains a number of metacognitive processes that are nearly impossible to assess. They include: "make connections to personal experiences, ideas in other texts, and society" (3.6.E); "create mental images to deepen understanding" (3.6.D); and "monitor comprehension and make adjustments such as re-reading, using background knowledge, asking questions, and annotating when understanding breaks down" (3.6.I).

A preponderance of the Composition and Inquiry and Research standards similarly focus on writing processes rather than learning outcomes. These process-focused standards are in planning, drafting, revising, and editing (e.g., plan a first draft, develop drafts, develop an engaging idea, revise drafts, edit drafts). More standards are devoted to writing processes (e.g., "revise drafts for clarity, development, organization, style, word choice, and sentence variety" (6.10.C)) than to writing production (e.g., "compose literary texts such as personal narratives, fiction, and poetry using genre characteristics and craft" (6.11.A)). The relative lack of emphasis on writing outcomes incorrectly suggests that the quality of the product is of less concern than the process that was used to create it.

A final critical omission is disciplinary literacy, or standards that describe how literacies are utilized in subject areas such as science, history, and technical subjects. There is no mention of this as an area of study and development in any grade level, though its absence is most problematic in the secondary grades, when students begin to apply their literacy skills to master content in several other important subject areas besides English. Content is only mentioned once in the high school Response Skills strand (E1.5.F: "respond using acquired content and academic vocabulary as appropriate"). Without clear language that supports application of disciplinary literacies in the secondary grades, students are less likely to master increasingly rigorous subject matter content in classes other than English (and teachers of other subjects are less likely to collaborate).

# Clarity & Specificity

## + Clarity & Specificity Strengths

With the exception of the second strand, Comprehension Skills, the majority of standards have grade-specific standards that progress in a logical fashion, with relatively few redundancies. The standards are free of jargon and use precise and concise language to describe expectations.

## − Clarity & Specificity Weaknesses

As indicated above, the lack of support materials diminishes the clarity and specificity of the standards. While these materials may be forthcoming, there is no reference to them at this time. Clarifying documents should include text and writing exemplars that illuminate the standards, a definition of text complexity, and a glossary of terms. In addition, the prominence of process-focused standards, which are largely not measurable, is likely to confound test developers.

## Documents Reviewed

- Texas Essential Knowledge and Skills for English Language Arts and Reading (2017), accessed from http://ritter.tea.state.tx.us/rules/tac/chapter110/index.html.
- Vertical alignment documents, accessed from https://tea.texas.gov/Academics/English_TEKS_Review/.

## Endnotes

1. The state anticipates that resources to support implementation of the new standards will be available in spring 2019 for K–8 and in spring 2020 for high school.

# Recommendations

1. Establish text complexity requirements that specify particular text complexity levels that students should be able to read at the various grade levels.
2. Develop discipline-specific literacy standards for grades 6–12 to communicate expectations for use outside of the English classroom.
3. Designate specific literary and informational texts at all grade levels with which students should be familiar (or at minimum, provide exemplar texts for teacher consideration).
4. Reduce the number of metacognitive and process standards that add little value and/or cannot be measured.
5. Provide supporting documents to guide educators, families, and curriculum developers in plenty of time ahead of implementation.
6. Revise the standards in the Comprehension Skills strand to significantly reduce the verbatim redundancies from kindergarten through high school and to clarify expectations by grade level.
7. Design college and career-readiness standards to anchor learning progressions from K–12.
8. Include expectations for genres/subgenres and literary elements that should be mastered in the literature standards.

## = Bottom Line

Significant revisions recommended. Standards should not be implemented until and unless these revisions are made.

English Language Arts

# Virginia

10 9 — **Strong**

*Recommend focus on the implementation of these standards.*

8 7 — **Good**

*Targeted revisions recommended along with a focus on implementation of these standards.*

6 5 — **Weak**

*Significant revisions recommended. Standards should not be implemented until and unless these revisions are made.*

4 3 2 1 — **Inadequate**

*Complete revision highly recommended. Standards have critical shortcomings and should not be implemented.*

## Overall Rating: Inadequate (4/10)

Content & Rigor (2/7) + Clarity & Specificity (2/3)

## Overview

The content and rigor of the English Standards of Learning for Virginia Public Schools are uneven, with serious omissions in Reading yet notable strengths in the Communication and Multimodal Literacies as well as Research strands. There is some internal coherence, especially as it relates to vocabulary across strands (Reading, Writing, and Communication). However, the standards are undermined by several substantial weaknesses, beginning with the inconsistent and misaligned foundational skills for elementary students. The standards also fail to distinguish between literacy as a developmental goal in elementary school and English as a subject of study in secondary school, and lack any specific text complexity requirements to guide teachers and students. Moreover, the standards fail to establish expectations about content or disciplinary literacy in other subject areas so that students develop the specialized skills needed to be college- and career-ready.

In general, the standards are largely measureable and free of jargon, making them understandable to the general public. However, the writing standards are less clear and specific than the other domains, and place too much emphasis on writing processes without establishing quality expectations for writing production. The standards also lack key supporting information to help guide implementation, such as guidance on text complexity. In sum, the confusing and inappropriate treatment of foundational skills, the absence of research standards until fourth grade, the lack of attention to text complexity, and the omissions of writing production and disciplinary literacy standards are serious problems that diminish the likelihood that Virginia's students will be well prepared for college or career.

# General Organization

The standards document begins with a one-page introduction and an explanation of the organization of the standards. Virginia's English Standards of Learning are organized by grade level (K–12), then further divided into four strands: Communication and Multimodal Literacies, Reading, Writing, and Research. Each grade level begins with a one-paragraph overview stating the major areas of emphasis in learning (e.g., multimodal presentations, writing) as well as outcome expectations. A curriculum frameworks document provides some guidance to teachers in the form of teacher notes and a graph of the learning progressions across grade levels. However, no information about the development of the standards or research base is provided, and the standards lack many supplemental resources to help guide their implementation (such as a glossary of key terms and guidance for determining text complexity).

# Content & Rigor

## + Content & Rigor Strengths

A notable strength of Virginia's standards is that they prioritize communication and multimodal literacies as essential to and inherent in the mastery of reading and writing. From the earliest grades, students are expected to consume and respond to a variety of media. In fourth grade, for example, they are asked to analyze media messages critically (e.g., "Compare and contrast how ideas and topics are depicted in a variety of media and formats" (4.3b)). This progression continues for students as they "craft and publish audience-specific media messages" (6.3.d) and "evaluate the motives…behind media presentations" (8.3.f) in later grades. The inclusion of this domain represents an important step in advancing the literacy skills of students across the K–12 landscape. Similarly, Research is called out as a specific strand, making it clear that students are expected to engage in investigations and produce original products using standards of documentation (e.g., how to cite sources and avoid plagiarism). Students in the primary grades are introduced to inquiry as a catalyst for research (e.g., "Generate questions to gather information" (1.14.b)). By middle school, research includes the language of critical inquiry (e.g., "Analyze and evaluate the validity and credibility of resources" (7.9.c)). This inclusion complements aspects of the aforementioned multimodal strand, suggesting some coherence within the standards themselves.

Vocabulary standards are extensive and specific throughout, and are linked to content learning. These standards deal with denotation, connotation, and morphology (the study of how words are formed in language), and are included in appropriate ways (e.g., "Choose vocabulary and tone appropriate to the audience, topic, and purpose"(8.2.b)). In writing, vocabulary appears as an important element for conveying information (e.g., "Revise writing for clarity of content using specific vocabulary and information" (4.7.m)) as well as craft (e.g., "Use precise and descriptive vocabulary to create tone and voice" (5.7.j)). This clear and consistent focus on vocabulary ensures that it is not viewed in isolation, and exercises due influence in the ways that we read and communicate across disciplines.

## – Content & Rigor Weaknesses

The content weaknesses fall into two categories: those that relate to rigor, and those that relate to coherence. Regarding the former, the standards are significantly undermined by the near-total omission of specifications for text complexity. For example, they require that students identify main ideas or the author's purpose or that they draw conclusions from texts, but fail to indicate how challenging these texts must be. Without requirements about how students are to progress in texts, or definitions of the quantitative, qualitative, and reader and task dimensions of text complexity, teachers are left to determine the levels of texts that are appropriate for their students. Reading comprehension goals are meaningless unless interpreted within the demands of specific texts or text levels. In other words, a teacher may believe that students are meeting a standard because they can demonstrate a particular skill, but that could be untrue since the text demands within which they demonstrate this skill are insufficiently difficult. The silence on expectations of progression through increasingly complex texts casts doubt on whether students will reach levels of skill, knowledge, and performance that are needed for success in post-secondary education and the workplace. Further, what constitutes "grade level" will vary widely, and could magnify inequities in expectations for all students.

The standards also lack any mention of specific works of outstanding literature or culturally important informational texts that students should read. Without some specifically

named texts, students could conceivably graduate from high school without ever reading a work by Shakespeare, or any foundational U.S. documents, for example. Additionally, there are no other text exemplars that might set a clear standard for rigorous expectations. While these omissions may intentionally leave curricular choices to local educators and schools, leaving what qualifies as a grade-level-appropriate text to individual interpretation makes it likely that all students will not be exposed to appropriately rigorous texts. When a text is mentioned, it is done in general terms (e.g., "fiction and nonfiction texts" throughout K–12; "fiction texts by British authors" in twelfth grade). Text types should include subgenres to illustrate the wide range of texts that Virginia students should engage with (e.g., satire, essays, and speeches are absent). This addition would contextualize the reading comprehension standards and, properly implemented, would ensure that students follow a realistic path to college- and career-readiness.

A further rigor-related concern is the low and confusing reading expectations established for primary grade students. For example, no standards related to actual reading of text by children appear for kindergarten, only a requirement that students ask and answer questions about text and that they use story grammars (plot, character, and setting) to retell. Presumably, these could be accomplished by simply listening to stories read to them by an adult. Similar concerns arise with regard to the first-grade requirements, as only then are students expected to master reading from left to right and from top to bottom (1.4.a), which is late as it is well within the capacity of kindergarteners to master these skills. Even in second grade, students are still focused on counting phonemes in one-syllable words, blending, and segmenting (2.3.a, b, c)—skills that should have been mastered by the end of first grade.

As reading comprehension progresses through the grades, the standards become repetitive and therefore what students are required to do also stagnates. For example, students are required to "draw conclusions and using text for support" (3.5.h) starting in third grade, with virtually no changes in the expectation through twelfth grade, and no spelled-out increase in the challenge of the text in which they are asked to do these things. In fact, many reading and writing standards remain startlingly similar across grade levels, with the result that some are simply below grade level. Consider grade 9, standard 9.5.j—"Differentiate between fact and opinion and evaluate their impact"—a skill that students should master in the elementary grades. Moreover, there are redundant expectations that students differentiate between fact and opinion in grades 4–7; in grade 7, the same expectation appears in two different standards.

Another area of weakness is insufficient attention to disciplinary literacy, which is the application of reading, writing, speaking, and listening in other subject areas. Some standards indirectly allude to disciplinary literacy (e.g., how vocabulary is dealt with across communication, writing, and reading standards), but there are no clearly identified standards for the use of literacy for subject area learning. For example, there is no clear requirement for secondary students to learn any of the specialized reading skills or text features of the disciplines (e.g., literature, history/social studies, science, mathematics), suggesting that reading and writing are not essential parts of these core-subject courses. "Cross-content reading" is cited in first grade and calls for "emphasis on materials in mathematics, science, and history and social science," but never again throughout grades 2–12. American history is mentioned only in the eleventh-grade standards. The standards note that students are to read in those other subjects, but there is no recognition of the specialized nature of texts or reading purposes/approaches in these other fields. In short, the standards are confusing and incomplete with regard to disciplinary literacy.

Also problematic is the misalignment of areas of instruction with regard to the developmental expectations of readers and writers. Fluency, an important foundation skill, is cited only in grades 1–3, although research suggests that it continues to develop through eighth grade. Phonemic awareness and phonics are confused as well. Phonemic awareness is not adequately addressed in kindergarten, even though research suggests that's the best time for its development; instead, it is emphasized in grades 1 and 2, at which point students should have long mastered the sounds of the language. Conversely, Phonics, which requires linking the sounds of the language to its alphabetic representations, is required at kindergarten, but what is required there goes well beyond what research suggests is appropriate. For example, K.6.b requires kindergarten students to "match consonant, short vowel, and initial consonant digraph sounds to appropriate letters," which is above the reach of most kindergarten students.

# Clarity & Specificity

## + Clarity & Specificity Strengths

Overall, the standards are clearly written and jargon-free, meaning that educators as well as the general public are likely to understand them. For instance, students in second grade "use and punctuate declarative, interrogative, and exclamatory sentences" in their writing (2.11.b), and in ninth grade "communicate clearly the purpose of the writing using a thesis statement" (9.6.e).

The majority of the standards appear to be measurable, an essential element for formative and summative assessment of progress toward goals. The standards are also specific in nature and do not contain excess verbiage.

## − Clarity & Specificity Weaknesses

Virginia's writing standards confuse writing processes with outcomes. Instead of delineating essential writing abilities and skills, they specify the kinds of writing experiences expected of students. For example, the standards specifically cite writing processes (e.g., "plan, draft, revise, and edit" in the introduction to grades 3 and 6–9, or use "prewriting strategies" in grades 2–8). However, these are a means toward an end, which is producing writing, and not outcome standards as such. Conversely, there is little direction as to the frequency or amount of writing that students are expected to produce. In the middle grades, there is language about "multiparagraph compositions" (grades 5–7), but volume, length, and explicit language describing extended writing never appear.

A final weakness is the lack of ancillary guidance for students, teachers, curriculum directors, test developers, and textbook writers. All would benefit in particular from the inclusion of performance expectations for text complexity and writing production and the addition of text exemplars and illustrative examples of standards.

## Documents Reviewed

English Standards of Learning for Virginia Public Schools and English Standards of Learning Curriculum Framework (2017), accessed from http://www.doe.virginia.gov/testing/sol/standards_docs/english/index.shtml.

# Recommendations

1. Establish text complexity requirements that specify particular text complexity levels that students should be able to read at the various grade levels.
2. Designate specific literary and informational texts at all grade levels with which students should be familiar (or at minimum, provide exemplar texts for teacher consideration).
3. Revise foundational reading skills (phonemic awareness, phonics, and fluency) to ensure that there is a sound progression reflecting the research-based developmental progression of these skills.
4. Revise writing standards to translate writing process standards into requirements that can be taught and measured. Standards that are only activities should be eliminated.
5. Develop discipline-specific literacy standards for grades 6–12 to communicate expectations for use outside of the English classroom.
6. Incorporate standards for research and investigation in grades K–3. Without them, students are significantly limited in their application of critical thinking skills.
7. Rewrite standards to eliminate redundancies in expectations across grades. Where appropriate, clarify different expectations at each grade level.

## = Bottom Line

Complete revision highly recommended. Standards have critical shortcomings and should not be implemented.

## Endnotes

1. As an added note, fiction and nonfiction are somewhat dated terms; literary and informational texts draw clearer distinctions between the purposes for texts being read and composed, and are reflective of current research.

English Language Arts

# West Virginia

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**Strong**

*Recommend focus on the implementation of these standards.*

**Good**

***Targeted revisions recommended along with a focus on implementation of these standards.***

**Weak**

*Significant revisions recommended. Standards should not be implemented until and unless these revisions are made.*

**Inadequate**

*Complete revision highly recommended. Standards have critical shortcomings and should not be implemented.*

## Overall Rating: Good (7/10)

Content & Rigor (5/7) + Clarity & Specificity (2/3)

## Overview

The West Virginia College- and Career-Readiness Standards for the English Language Arts are coherent, well organized, and free of jargon. They provide educators, students, and stakeholders with measurable standards that are anchored by college- and career-readiness outcome standards that display how grade level standards build toward these outcomes. The standards have several notable content strengths, including clear, developmentally appropriate Early Learning Foundations standards for students in grades K–5, and measurable writing standards that appropriately balance writing processes with writing products or outcomes.

However, the standards are undermined by several significant omissions, and would be greatly strengthened by the addition of standards on disciplinary literacy, qualitative definitions of text complexity, attention to text exemplars to guide educators.

## General Organization

West Virginia's College- and Career-Readiness English Language Arts (ELA) Standards are presented for individual grades. The standards themselves are organized into five domains: Reading, Writing, Speaking/Listening, Language, and Early Learning Foundations (specific to K–5, addressing phonemic awareness, phonics, word recognition, fluency, and handwriting). Each set of grade-level standards is introduced with a chart that summarizes several major characteristics of the expectations in reading, writing, speaking/listening, and language. This chart serves as an advance organizer for the detailed standards themselves. Grade-level standards are anchored by college- and career-readiness (CCR) standards, which

communicate the general knowledge and skills expected of West Virginia graduates. The standards document also addresses quantitative text complexity expectations, distribution of text types, and distribution of writing types. The standards are accompanied by an auxiliary crosswalk document that details the changes made to the state's prior standards.

# Content & Rigor

## + Content & Rigor Strengths

West Virginia's ELA standards have several notable content strengths. The early learning foundational skills domain follows an appropriate and accurate developmental progression. By linking the sounds, graphs, and grammars of the language to fluency, word recognition, and concepts of print, this domain offers clear and coherent guidance to primary educators and ensures that students are not learning discrete skills in isolation. For instance, the introductory chart for kindergarten states that students are required to "name upper-and lower-case letters, recognize the structure of sounds in language, and match letters with their sounds and print them."

The reading standards similarly convey a generally appropriate progression of deepening comprehension and critical thinking, and require that students cite evidence from text. For example, ninth-grade students "delineate and evaluate the argument and specific claims in an informational text, assessing whether the reasoning is valid and the evidence is relevant and sufficient; identify false statements and fallacious reasoning" (9.16). This standard is part of the Integration of Knowledge and Ideas cluster within the reading standards, and is consistently noted throughout K–12. This approach to language development emphasizes reasoning as students read, discuss, and write about grade level topics and texts.

The writing standards are also largely measurable and focused on writing outcomes. For example, when writing opinion pieces, fourth graders are expected to "link opinion and reasons using words and phrases (e.g., for instance, in order to, or in addition)" (4.20). Many of the writing standards also emphasize the quality of the writing produced, while limiting language on the processes of writing (which, though useful, are not measurable). For example, third-grade students "use dialogue and descriptions of actions, thoughts, and feelings to develop experiences and events or show the response of characters to situations" (3.22). Similarly, eighth-grade writers "develop the topic with relevant, well-chosen facts, definitions, concrete details, quotations, or other information and examples" (8.21). These standards are measurable and specific, and appropriately strike the balance needed between writing processes and writing products.

## – Content & Rigor Weaknesses

Several important gaps detract from the rigor of West Virginia's ELA standards. First, the standards lack direction regarding qualitative text complexity. While the quantitative measures (e.g., Lexile level) provided give an initial description of a text, they rely on calculations of average sentence length, number of syllables, and the presence of rare words. However valuable, this guidance is insufficient. Qualitative measures such as the purpose and meaning, language conventions and clarity, text structures, and knowledge demands of texts would allow teachers to make more nuanced decisions about the relative complexity of a text. Clear expectations that demonstrate a rising level of text complexity across grades also help ensure all students are exposed to appropriately rigorous texts.

Second, the standards provide scant guidance on genres and subgenres of literary and informational texts. Folktales and fables are mentioned in third-grade standards, but not again. Biography and memoir are used as examples in sixth-grade standards, as it relates to comparing two texts, but neither is identified as an important type of text that students should read. Similarly, speeches and essays are used as examples (e.g., Roosevelt's Four Freedoms speech, Martin Luther King Jr.'s Letters from a Birmingham Jail) but not further identified as necessary text types. Epic poetry, opinion pieces, and long-form journalism are not mentioned at all. There are scattered nods to specific works (e.g., "how Shakespeare treats a theme or topic from Ovid or the Bible" (10.14)) but the scarce mention of genres and subgenres, coupled with the lack of a broad range of complex texts exemplars, leaves individual educators to divine from where a "deep knowledge of eighteenth-, nineteenth-, and early-twentieth-century foundational works of American literature" might come (11.14, 12.14).

The absence of a coherent set of illustrative texts or exemplars that convey the intentions of the standards further exacerbates these omissions. Without an illustrative texts list, educators and curriculum developers have little direction in terms of the range and depth of texts to be used.

This, in turn, mutes the overarching goal of college- and career-readiness for West Virginia students. Without a rich array of texts from historical to contemporary, students are likely to encounter too narrow a range of texts.

Similarly, there are no writing exemplars to illuminate the expectations of the standards. Student writing exemplars are useful for clearly communicating exactly what learners should be expected to do. As with text exemplars, these assist educators, curriculum developers, and test developers in calibrating student work to the standards.

A final major omission is that the standards make no mention of discipline-specific literacies in middle and high school. Thus they fail to show how reading, writing, language, and speaking/ listening extend beyond the English classroom into the domains of science, social studies, and other technical subjects. (Note that the content standards in science and social studies also lack robust literacy standards.) Transfer of learning, the ability to apply knowledge and skills in new and novel situations, is essential in order to be prepared for college and careers. Given that literacy is foundational for learning—we read, write, speak, listen, and view in all subjects—this omission is significant. Together, these shortcomings significantly undermine the rigor and leave gaps in the content of West Virginia's standards.

# Clarity & Specificity

## + Clarity & Specificity Strengths

The West Virginia College- and Career-Readiness Standards are largely coherent, clearly written, measureable, and free of jargon that might interfere with a user's understanding of the document. Additional information and examples provided further help illuminate the standards (e.g., specifically calling for Shakespearean text in grade 8 and recommending the use of Modern Language Association and American Psychological Association style manuals).

The organizational layout of the standards is clear and user-friendly. Each set of grade-level standards features a short introduction highlighting a few major concepts, which provides an advance organizer for the standards that follow. The inclusion of an Early Learning Foundations domain, which captures standards related to fluency, phonics, and other key skills from the Reading, Writing, and Language domains, accurately illustrates the integrative and reciprocal nature of these standards. Supplementary resources also contribute helpful information regarding how to implement the standards (such as a document on the Teacher Resources for Educational Excellence, or TREE, an online platform sponsored by the state department of education that offers additional curricular, instructional, and assessment supports). Each grade-level document also helpfully includes a letter for families explaining the major features and expectations of the standards.

## – Clarity & Specificity Weaknesses

Although the high school standards are delineated by grade level, it is extremely difficult to distinguish between standards in grades 9 and 10 or between those in grades 11–12. For example:

- *Analyze how complex characters (e.g., those with multiple or conflicting motivations) develop over the course of a literary text, interact with other characters, and advance the plot or develop the theme (9.3).*
- *Analyze how complex characters (e.g., those with multiple or conflicting motivations) develop over the course of a literary text, interact with other characters, and affect the plot or develop the theme (10.3).*

It is unclear how "advancing the plot" and "affecting the plot" are significantly different from one another. Unfortunately, a majority of the high school standards have no variance between the 9–10 or 11–12 grade bands. Without grade-specific standards, it is unclear how and when students should be exposed to progressively more rigorous content and how they will ultimately achieve college- and career-readiness.

# Recommendations

1. Articulate what "text complexity" means beyond the single quantitative measure provided. Provide guidance on elements of complexity (structure, language conventions, levels of meaning, knowledge demands).
2. Designate specific literary and informational texts at all grade levels with which students should be familiar (or at minimum, provide exemplar texts for teacher consideration).
3. Add expectations for genres/subgenres and literary elements that should be mastered in the literature standards.
4. Develop discipline-specific literacy standards for grades 6–12 to communicate expectations for the use of reading and writing outside of the English classroom.
5. Revise the high school standards to clarify the differences between grade levels, and ensure each standard progresses in rigor from one grade to the next.

## Bottom Line

Targeted revisions recommended along with a focus on implementation of these standards.

## Documents Reviewed

- West Virginia College- and Career-Readiness Standards for English Language Arts (July 2016), accessed from:
  - https://webtop.k12.wv.us/0/apps/tree/static/doc/wvccr-k-2.pdf; https://webtop.k12.wv.us/0/apps/tree/static/doc/wvccr-3-5.pdf;
  - https://webtop.k12.wv.us/0/apps/tree/static/doc/wvccr-ela-middle.pdf; and
  - https://webtop.k12.wv.us/0/apps/tree/static/doc/wvccr-ela-high.pdf.

Mathematics

# Common Core State Standards

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**Strong**

*Recommend focus on the implementation of these standards.*

**Good**

*Targeted revisions recommended along with a focus on implementation of these standards.*

**Weak**

*Significant revisions recommended. Standards should not be implemented until and unless these revisions are made.*

**Inadequate**

*Complete revision highly recommended. Standards have critical shortcomings and should not be implemented.*

## Overall Rating: Strong (9/10)

Content (7/7) + Communication (2/3)

## Overview

The Common Core State Standards for Mathematics (CCSS-M) provide a high quality foundation for a K–12 mathematics program. At the elementary level (K–5), they appropriately specify a strong focus on arithmetic, including both the mastery of computations and the understanding of concepts. At the middle school level, they lay a firm foundation for high school algebra by treating the important topics of "Ratio and Proportionality" and "Linearity" in depth, while also completing the study of the arithmetic of rational numbers and developing important concepts and skills in "Geometry" and "Probability and Statistics." Finally, in high school, the main content areas are identified and developed by conceptual category, and the 148-page appendix describes numerous approaches to assembling these standards into courses, making the high school standards versatile but less user-friendly than the K–8 standards.

Helpfully, each grade in K–8 and each content area in high school begins with an introduction that describes the critical areas of instruction and an overview that lists the key topics. In addition to these features, there are also well articulated Standards for Mathematical Practice that are to be regularly connected and integrated with the mathematical content standards. Overall, the CCSS-M provides an excellent basis for achieving college- and career-readiness; states that have adopted these standards should continue to focus on their implementation.

## General Organization

The Content Standards form the bulk of the CCSS-M. These standards are presented by grade at the elementary and middle school levels and by broad conceptual category at the high school level. Within each K–8 grade, the standards

are organized by content domain (e.g., Number and Operations in Base 10), and within each domain they are organized into "clusters" that group individual standards into a conceptual unit. (For example, "Use place value understanding and properties of operations to add and subtract.")

The content domains are grade appropriate. For example, Number and Operations–Fractions appears in grades 3–5, while The Number System (which includes standards concerning irrational numbers) appears in grades 6–8. The online version of the CCSS-M also includes a separate listing of all K–8 content standards by content domain, making it easy to see how topics at a given grade level build on content from prior years and lay the foundation for future years.

The high school standards are presented in six conceptual categories: Number and Quantity, Algebra, Functions, Modeling, Geometry, and Statistics and Probability. The standards for each conceptual category except Modeling are grouped into domains and then clusters. Modeling does not have specific content standards attached to it. Instead, standards in the other categories that are connected to modeling are identified with a star. The high school standards include both "college- and career-ready" standards intended for all students and "plus standards" (indicated with a plus sign) that students should learn if they intend to take more advanced courses such as Calculus, AP Statistics, or Discrete Mathematics. These plus standards include topics such as numbers and operations in the complex plane, vectors, matrices, the binomial theorem, random variables, and probability distributions.

As noted in the overview, the Standards for Mathematical Content are complemented by eight Standards for Mathematical Practice. These are described in detail at the beginning of the CCSS-M and then included in short form in the introduction to each grade (K–8) and each high school category. The CCSS-M states: "Designers of curricula, assessments, and professional development should all attend to the need to connect the mathematical practices to mathematical content in mathematics instruction."

Mathematics *Appendix A* of the CCSS-M describes a number of approaches to assembling the high school standards into specific courses, including a traditional sequence (Algebra I, Geometry, Algebra II) and an integrated sequence. (The traditional sequence Geometry course also includes probability.) Courses are presented as collections of units (e.g., Traditional Algebra II has four units, the third of which is Modeling with Functions), and each unit contains instructional notes on the associated clusters and standards. In addition to the sequences mentioned above, *Appendix A* also describes accelerated pathways (beginning in grade 7) that allow students to reach calculus while in high school.

In addition to the content standards, the practice standards, and the information in Mathematics *Appendix A*, the CCSS-M also include a Glossary and a Sample of Works Consulted.

# Content

The Common Core State Standards for Mathematics are rigorous. The standards for grades K–8 are strong on content, highly coherent, and well paced. And they do an excellent job with key topics such as place value, fractions, proportionality, linearity, and basic geometry. The high school standards are also very solid from a content standpoint, although they must be read together with *Appendix A* to be fit into actual courses. Finally, the Mathematical Practice standards are described with care and explicitly articulate the need "to connect the Mathematical Practices to mathematical content in mathematics instruction."

## + Content Strengths

The CCSS-M are particularly strong at the elementary level, where they focus on numeracy and arithmetic in a manner that supports computational fluency, conceptual understanding, and problem solving. Place value—the foundational structure for whole number and decimal arithmetic as well as approximation—is treated coherently in the CCSS-M, and is the main focus of the Number and Operations in Base 10 content domain. Students use strategies and models to develop conceptual understanding of numbers and operations, and are asked both to master specific skills (e.g., computing using the standard algorithm) and to choose the best way to solve a given arithmetic problem with a simplifying feature (e.g., multiplying 998 and 73 by subtracting 146 from 73,000). The development of fractions via unit fractions—a new approach for the United States—is outstanding, and the CCSS-M promote coherence by assigning this key topic an entire content domain, Number and Operations—Fractions. Other content domains, such as "Geometry" and "Measurement and Data" are included at the K–5 levels, and many of the topics they include support the critical focus on arithmetic at these grade levels. In particular, linear measurement is used to develop the

important concept of the number line, and the measurement of area gives rise to the area model for multiplication.

At the middle school level, the focus of the CCSS-M broadens considerably. For example, in addition to learning about ratio and rate and the division of fractions, students in grade 6 also learn about writing, interpreting, and using expressions and equations, and about statistical thinking. Each middle school grade has clearly articulated foci, and the level of rigor remains high. For example, students in grade 8 are expected to "explain a proof of the Pythagorean Theorem and its converse," and to "use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept." Overall, the middle school standards provide an excellent foundation for high school algebra, geometry, and statistics and probability.

Like the K–8 standards, the high school standards are rigorous, and each of the broad conceptual categories is developed in detail. The standard sequence of Algebra I, Geometry, and Algebra II that is described in Mathematics *Appendix A* is well organized. The geometry sequence features a healthy emphasis on geometrical understanding and mathematical reasoning that will stand students in good stead as they learn to analyze geometrical situations on their own. Several categories are related to algebra, and these too develop both skills and comprehension. Finally, Statistics and Probability is organized into four domains that deal with topics such as the interpretation of data and using probability to make decisions, and is appropriately connected to functions (e.g., lines of best fit) and modeling.

### − Content Weaknesses

Although most features of arithmetic are clearly laid out in the elementary grades, there are a few gaps. Specifically:

- There could be more emphasis on the "make/unmake a 10" strategy for learning the addition facts (for sums above 10).
- There is no mention of the fact that dividing by a number is the same as multiplying by its reciprocal.
- Mixed numbers could be put on the number line shortly after they are introduced.
- When decimals are compared in fourth grade, this comparison could be specifically and explicitly tied to the number line.

Similarly, in middle school, there are some small oversights. In particular:

- The Introduction to grade 6 states that "… students discuss, develop, and justify formulas for areas of triangles and parallelograms." However, the language of the actual standard asks only that students "Find the area of right triangles, other triangles, special quadrilaterals, and polygons by composing into rectangles or decomposing into triangles and other shape" (6.G.1).
- In grade 8, students work extensively with equations of lines in the form y=mx+b, but they are never clearly asked to determine the equation of a line from its slope and a point or from two points.

Finally, there are a few specific oversights at the high school level. Namely:

- Composition of functions is only treated as a plus standard, despite the fact that it is used extensively in geometry.
- Polar coordinates are mentioned only in the context of the complex plane (in a plus standard), and are never developed for the real Cartesian plane.
- There could be more development of linear algebra. For example, Gaussian elimination is not included.
- The double and half angle formulas for sine and cosine are not mentioned (even in the plus standards).

## Communication

The CCSS-M include many important features that are useful from a communication standpoint, from helpful introductions to each grade in K–8 and each conceptual category in high school, to clear and detailed individual standards, to an organizational approach that joins standards that are part of the same larger topic. However, the decision to defer the organization of the high school standards into specific courses to an appendix imposes an unnecessary burden on teachers and curriculum developers.

## + Communication Strengths

The organization of the CCSS-M is exemplary at the K–8 level. In particular, the organization by content domains is excellent, and underlies the focus and depth that is a critical feature of the standards. Between them, these domains encompass the key mathematical themes that ought to be a part of every math curriculum, each of which is developed systematically in the appropriate range of grades. Within each grade, the content domains are divided into clusters made up of individual standards, so that different aspects of a common topic are visibly related. At the high school level, the conceptual categories are well chosen and the main topics are treated thoroughly, especially if the plus standards are included.

The introductions to each grade (K–8) and each conceptual category (at the high school level) provide succinct and helpful descriptions of the main goals, and should be useful to teachers and curriculum developers. In general, these introductions make excellent choices about what is important and communicate this information clearly. Each introduction is followed by a one-page overview that presents the clusters for each content domain in bullet point format. This helpfully emphasizes the larger conceptual units that the soon-to-be-presented individual standards are parts of, thus supporting curricular coherence.

The individual standards establish clear and specific expectations, and often include helpful examples, as illustrated by the following fifth-grade standard:

> *Interpret division of a whole number by a unit fraction, and compute such quotients. For example, create a story context for 4 ÷ (1/5), and use a visual fraction model to show the quotient. Use the relationship between multiplication and division to explain that 4 ÷ (1/5) = 20 because 20 × (1/5) = 4 (5.NF.7.b).*

Importantly, the grain size of the individual standards is relatively uniform—meaning that each standard covers a similar amount of content. This makes it easier for teachers to set an appropriate pace to cover each standard.

The CCSS-M online also presents the standards organized by content domain, a format that makes it easy to see how topics are developed across grades. Further information about the connections between content areas is provided by the K–8 "coherence map" developed by Achieve the Core, which is available at https://achievethecore.org/coherence-map/.

## − Communication Weaknesses

While the K–8 standards support the development of curricula and provide excellent guidance to teachers, the high school standards, though of high quality, are more difficult to use. Most importantly, their division into conceptual categories defers the critical question of how to organize the material into courses to Mathematics *Appendix A*. And the sheer length of that document, which is more than one-and-a-half times the length of the actual standards, makes it difficult to get a focused snapshot (especially with no table of contents). This is particularly problematic because a given cluster may include a mix of regular and plus standards, the latter of which are not required to achieve "college- and career-readiness" but are highly recommended for college-bound students. In short, although most of the necessary information is included in some form, the organization of the high school standards imposes an unnecessary burden on teachers and curriculum developers.

In contrast, the brevity of the Mathematical Practices leaves them vulnerable to misinterpretation or overly narrow interpretation. For example, Practice 6 ("Attend to precision") might be interpreted as referring only to decimal rounding and drawing straight lines. Similarly, Practice 4 ("Model with mathematics") could be interpreted as an instruction to use manipulatives. And the distinction between Practice 7 ("Look for and make use of structure") and Practice 8 ("Look for and express regularity in repeated reasoning") is subtle and easy to overlook.

In each of these cases, the full narrative describing the topline statement is helpful. However, in practice the nuances may get lost.

Finally, there are minor differences between the online version of the CCSS-M and the pdf version that is available to download. For example, the second cluster in the online version of 4.NF expects students to "build fractions from unit fractions," while the pdf version expects them to "build fractions from unit fractions by applying and extending previous understandings of operations on whole numbers."

# Recommendations

If and when the CCSS-M are revised, we recommend the following:

1. Provide examples of the Standards for Mathematical Practice and do more to support their integration with the content standards.
2. Reorganize the high school standards so they are first presented by course (the way they are most often used) and describe each course in a more focused manner, similar to the way the standards for grades K–8 are currently presented. (California's 2013 Common Core State Standards do exactly this, for both traditional and integrated pathways, in under fifty pages.)
3. Include standards for "fourth-year courses" such as Precalculus.
4. Provide teachers with more explanation for the shift to developing geometry by defining congruence and similarity via transformations of the plane, rather than from the Euclidean axioms.
5. Address the minor content gaps noted above.

In addition to these changes, those involved in future revisions may wish to consider providing explicitly aligned content standards for pre-K (as Massachusetts does) and/or for more advanced high school courses such as "Probability and Statistics" and "Calculus" (as California does).

## Bottom Line

Recommend focus on the implementation of these standards.

## Documents Reviewed

Common Core State Standards Initiative Math Standards (2010), accessed from http://www.corestandards.org/Math/. Additional resources can also be found on the site page.

Mathematics

# Indiana

10 9 **Strong**

*Recommend focus on the implementation of these standards.*

8 7 **Good**

***Targeted revisions recommended along with a focus on implementation of these standards.***

6 5 **Weak**

*Significant revisions recommended. Standards should not be implemented until and unless these revisions are made.*

4 3 2 1 **Inadequate**

*Complete revision highly recommended. Standards have critical shortcomings and should not be implemented.*

## Overall Rating: Good (7/10)

Content (5/7) + Communication (2/3)

## Overview

The Indiana Academic Standards for Mathematics (IAS 2014) are a thoughtful synthesis of the IAS 2000 and the CCSS-M. Overall, they are focused and coherent, and in general the level of rigor is good—with some unfortunate exceptions in grades 3–5, where it is apparent that conscious decisions were made to deemphasize long division, fluency with the standard algorithms, and addition and multiplication facts. The IAS are also clearly written and appropriately specific. However, a few areas are vulnerable to misinterpretation by curriculum developers, publishers, and teachers. For example, there are no introductions or curricular foci for each grade (K–8) or course (in high school). And the Process Standards do not include examples, and therefore fail to distinguish between process opportunities for younger and older students.

## General Organization

At the K–8 level, the IAS 2014 are organized into four major content strands, each with its own progression. The high school standards are organized into ten courses: Algebra I, Math 10, Algebra II, Calculus, Finite Math, Geometry, Pre-Calculus, Probability and Statistics, Trigonometry, and Quantitative Reasoning. In many cases, the IAS consolidate multiple (sometimes edited) CCSS-M standards into one standard so as to incorporate pre-existing Indiana items. Consequently, there are a total of 273 K–8 standard items—far fewer than the 314 found in the Common Core. In addition to the content standards, the Standards Resource Guide Documents contain clarifying examples, which are critical to the success of the IAS.

# Content

For the most part, the IAS are rigorous. However, there is a consistent brevity regarding conceptual development that is sometimes problematic. And there are fundamental problems with the grade 3–5 standards, where it is apparent that conscious decisions were made to deemphasize the fluent recall of addition and multiplication facts, fluency with the standard algorithm for each of the four operations, and long division. Consequently, compared to other state standards, the IAS provide students in grades 3–5 with a weaker foundation upon which to build toward the higher expectations in subsequent grades.

## + Content Strengths

At the K–2 level, the IAS contain cognitively demanding expectations that are grade-level appropriate. For example, students are expected to "identify objects that do not belong to a particular group and explain the reasoning used" (K.DA.1).

The inclusion of standards that require students to *create* sample cases is also a welcome addition that other states may wish to consider. For example, first-grade students in Indiana are expected to "create a real-world problem to represent a given equation involving addition and subtraction within 20" (1.CA.3).

Most of the standards for grades 6–8 are also focused, coherent, and rigorous. And again, there are subtle improvements over the CCSS-M. For example, the bolded text in the following IAS 2014 standard does not appear in the equivalent CCSS-M standard:

> *Write an inequality of the form $x > c$, **$x \geq c$**, $x < c$, **or $x \leq c$, where c is a rational number, to represent a constraint or condition...** (6.AF).*

By expanding the range of expressions that students are expected to work with, this standard improves on the original CCSS-M version. Finally, at the high school level, the Algebra I and II standards in the IAS are a respectable (if somewhat awkward) hybrid of the CCSS-M's elegantly reusable algebraic core concepts/habits and IAS 2000's canonical course-based topic lists.

## – Content Weaknesses

One of the main weaknesses of the IAS 2014 is that they do not specifically require students to add, subtract, multiply, and divide using "the standard algorithm." Instead, students are expected to use "a standard algorithmic approach." This is a confusing phrase, since to compute efficiently one either uses the standard algorithm or one uses one of the many non-standard algorithms. This phrase appears five times (see standards 4.C.1, 5.C.1, 6.C.1, 6.C.2, and 7.C.7), and in each of these cases it has the potential to confuse or weaken expectations at a critical juncture.

Most states expect students to multiply and divide fluently within 100 by the end of third grade. However, the IAS 2014 postpone this expectation until fourth grade (see 4.C.4). Consequently, fourth-grade students in Indiana are expected to "solve real-world problems involving addition and subtraction of multi-digit whole numbers" (4.AT.1), while students in other states are expected to "solve multistep word problems posed with whole numbers and having whole-number answers using the four operations, including problems in which remainders must be interpreted" (4.OA.3).

These unusually low expectations and the consistent deemphasizing of division are problematic in the long run. For example, a sixth-grade standard (6.NS.5) sets a high standard by requiring conversion "between any two representations (fractions, decimals, percents) of positive rational numbers without the use of a calculator." So how does one convert from a fraction to decimal without knowing and using division? The Resource Guide Document provides the following example:

> *Write the other two representations (fraction, decimal, percent) for each number.*
>
> *a) 34 b) 44% c) 1/3 d) 2.5*

A problem like the one above does not require division. However, in the long run, it is unwise to shy away from long division.

Because they seek to retain essential elements of both IAS 2000 and CCSS-M, the grades 6–8 standards lack critical conceptual development details, which most teachers expect and appreciate. This is especially true in areas such as ratio/proportion and expression/equations, where there are also some inconsistent or misplaced expectations. For example, the following fifth-grade standard uses skills and terms that are typically covered in middle school:

> *Define and use up to two variables to write linear expressions that arise from real-world problems, and evaluate them for given values (5.AT.8).*

In addition to these weaknesses, Indiana's Process Standards lack examples, meaning they fail to distinguish between process opportunities for younger and older students. In contrast, many states have developed grade-specific (or grade-band-specific) examples to help teachers implement such process standards.

# Communication

The IAS are mostly clear and concise, although a few standards are missing some important details.

## + Communication Strengths

For the most part, the IAS are clear and concise. However, in some places they are vulnerable to misinterpretation. The *Resource Guide Documents*—which contain clarifying examples, key vocabulary terms, and additional digital resources—help with interpretation. And the inclusion of online *Vertical Articulations*, plus *Links for Educators, Parents, and Community* is commendable.

## − Communication Weaknesses

The concision of the IAS 2014 is attractive. However, in some cases, it comes at the expense of critical mathematical or pedagogical details.

For example, consider the following CCSS-M standards:

- *Fluently add and subtract within 20 using mental strategies. By end of grade 2, know from memory all sums of two one-digit numbers (2.OA.2).*
- *Fluently add and subtract within 100 using strategies based on place value, properties of operations, and/or the relationship between addition and subtraction (2.NBT.5).*

According to the IAS 2014 standards correlation guide, these standards have been condensed into the following standard: "Add and subtract fluently within 100" (2.CA.1).

Obviously, 2.CA.1 is more concise than the combination of 2.OA.2 and 2.NBT.5. However, it was unwise for the authors of the IAS to omit the essential milestones for multi-digit addition and subtraction that are explicitly or implicitly included in the more lengthy CCSS-M standards. These milestones include: (1) the conceptual development of the base-10 place value system, which culminates in the complete understanding of the number 20, (2) the fluent recall of all sums of two single-digit numbers, and (3) the conceptual understanding of addition and subtraction (through the use of "strategies based on place value, properties of operations, and/or the relationship between addition and subtraction").

Unfortunately, this oversight is no accident, as demonstrated by the following passage from the Standards Correlation Guide document:

> *IAS 2014 does not require students to specifically use strategies based on place value, properties of operations, and/or the relationship between addition and subtraction as is found in CCSS to add and subtract fluently within 100.*

This statement is indefensible. After all, if a teacher is teaching addition and subtraction strategies that are *not* "based on place value, properties of operations, and/or the relationship between addition and subtraction," these strategies are likely mathematically questionable.

Further evidence that this ambiguity is undesirable can be found in the IAS 2014 standard on addition and subtraction within 1000. Indeed, when the two standards are viewed side-by-side, it is clear that the standard for addition and subtraction within 100 is deficient.

- *Add and subtract fluently within 100 (2.CA.1) .*
- *Add and subtract within 1000, using models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; describe the strategy and explain the reasoning used. Understand that in adding or subtracting three-digit numbers, one adds or subtracts hundreds and hundreds, tens and tens, ones and ones, and that sometimes it is necessary to compose or decompose tens or hundreds (2.CA.4).*

If anything, teachers should take more care when teaching addition and subtraction within 100 than they take when teaching addition and subtraction within 1000. Yet the IAS take a different approach.

In addition to the problematic brevity of some standards, the IAS 2014 also have other communication weaknesses. Most notably, unlike most state standards, they do not have introductory statements at the beginning of each grade (or course) that describe the most critical areas of instruction. Consequently, there is a danger that teachers will not understand which topics deserve the most attention.

## Recommendations

1. Replace the phrase "using a standard algorithmic approach" with the phrase "using the standard algorithm" wherever the former appears.
2. Include explicit language on addition and multiplication facts, similar to the following:
   - *By end of grade _, know from memory sums all of two one-digit numbers.*
   - *By the end of grade _, know from memory all products of two one-digit numbers.*
3. Include essential statements in standards on conceptual development to guide teachers.
4. Provide introductions and curricular foci for each grade (K–8) and each high school course.
5. Make explicit the connections between high-leverage mathematical topics. (For example, connect the distributive property to multi-digit multiplication.)
6. Fix other missed opportunities in the IAS 2014.

   Example 1:

   - *3.M.7 Find perimeters of polygons given the side lengths or by finding an unknown side length.*
   - *[Sample Improved Wording] Solve real-world and mathematical problems involving perimeters of polygons, including finding the perimeter given the side lengths, finding an unknown side length, and exhibiting rectangles with the same perimeter and different areas or with the same area and different perimeters.*

   Example 2:

   - *2.NS.3 Plot and compare whole numbers up to 1,000 on a number line.*
   - *[Sample Improved Wording] Represent whole numbers as lengths from 0 on a number line diagram with equally spaced points corresponding to the numbers 0, 1, 2,..., and represent whole-number sums and differences within 100 on a number line diagram.*

### Bottom Line

Targeted revisions recommended along with a focus on implementation of these standards.

## Documents Reviewed

Indiana Academic Standards for Mathematics (IAS 2014), accessed from https://www.doe.in.gov/standards/mathematics; additional resources can be found on the site page.

Mathematics

# Minnesota

10 9 8 7 6 5 4 3 2 1

**Strong** — *Recommend focus on the implementation of these standards.*

**Good** — *Targeted revisions recommended along with a focus on implementation of these standards.*

**Weak** — *Significant revisions recommended. Standards should not be implemented until and unless these revisions are made.*

**Inadequate** — *Complete revision highly recommended. Standards have critical shortcomings and should not be implemented.*

## Overall Rating: Weak (6/10)

Content (4/7) + Communication (2/3)

## Overview

The Minnesota Mathematics Standards K–12 were adopted in 2007 and scheduled to be reviewed during the 2015–16 school year. However, that review has since been postponed until 2021–2022, by which time the current standards will have been in use for 14 years. Although the 2007 standards were reviewed somewhat favorably in *The State of State Standards and the Common Core*,[1] they need to be revised at this time to reflect critical content and pedagogical shifts in pre-K–12 mathematics.

The current standards have several notable weaknesses. For example, they suggest the use of process standards, but do not directly address them within the mathematical content strands. Additional concerns include the lack of clarity around expectations of mastery and/or fluency, and the overly broad nature of the high school standards, which make no distinctions between grade levels.

Ideally, the next revision would more clearly communicate how the standards are to be implemented—especially at the high school level—and more sharply define the processes while integrating them with the content standards. The current standards in the areas of "Number and Operation" (grades K–5) and "Algebra" and "Data Analysis and Probability" (grades 6–8) should serve as the foundation from which to develop the revised standards. The Minnesota Department of Education site for mathematics (see *Documents Reviewed*) and the related materials housed there will be helpful in revising the standards.

# General Organization

In grades K–8, the Minnesota Mathematics Standards are organized by grade level into four content strands: Number and Operation, Algebra, Geometry and Measurement, and Data Analysis and Probability. However, in grades 9–11, there are only three strands: algebra, geometry and measurement, and data analysis and probability. For each grade level (K–8), standards are presented by strand, and numbered benchmarks articulate what is expected of students within each strand. (Specifically, the latter are intended to "inform and guide parents, teachers, school districts and other interested persons and for use in developing tests consistent with the benchmarks."[2]) At the high school level, Minnesota requires three years of mathematics, which must include content in algebra, geometry, and statistics and probability. Finally, there are a number of courses students may take during their twelfth grade year, including Precalculus, AP Statistics, AP Computer Science, and discrete mathematics.[3]

The introduction to the Minnesota Mathematics Standards K–12 notes that "the standards and benchmarks presented here describe a connected body of mathematical knowledge that is acquired through the processes of problem solving, reasoning and proof, communication, connections, and representation."[4] However, this is the only mention of mathematical processes or practices in Minnesota's standards.

# Content

The Minnesota Mathematics Standards K–12 have a strong focus on arithmetic at the elementary level and a coherent algebra sequence at the middle school level. They also strike an appropriate balance between conceptual understanding and procedural fluency. However, they give short shrift to application. And the mathematical processes referenced in the introduction are never fully articulated or connected to the content standards.

## + Content Strengths

Minnesota's elementary standards are appropriately focused on arithmetic, and on the various models and representations that help students understand it. For example, the number line is introduced as a representational tool as early as the first grade:

> *Use words, pictures, objects, length-based models (connecting cubes), numerals and number lines to model and solve addition and subtraction problems in part-part-total, adding to, taking away from and comparing situations (1.1.2.1).*

The following third-, fifth-, and sixth-grade benchmarks also thoughtfully engage students in using the relationship between addition and subtraction and estimation to assess the reasonableness of results:

- *Use addition and subtraction to solve real-world and mathematical problems involving whole numbers. Use various strategies, including the relationship between addition and subtraction, the use of technology, and the context of the problem to assess the reasonableness of results (3.1.2.2).*
- *Estimate sums and differences of decimals and fractions to assess the reasonableness of results (5.1.3.3).*
- *Estimate solutions to problems with whole numbers, fractions and decimals and use the estimates to assess the reasonableness of results in the context of the problem (6.1.3.5).*

At the middle school level, the development of algebra in grades 6–8 is coherent and particularly aggressive, with the eighth-grade standards and benchmarks encompassing material that is typically mastered in an Algebra I course.

Finally, linear equations and quadratics are well established in the grade 9–11 standards, as demonstrated by the following benchmarks within standard 4 of the Algebra content strand for grades 9–11:

- *Represent relationships in various contexts using quadratic equations and inequalities. Solve quadratic equations and inequalities by appropriate methods including factoring, completing the square, graphing and the quadratic formula. Find non-real complex roots when they exist. Recognize that a particular solution may not be applicable in the original context. Know how to use calculators, graphing utilities or other technology to solve quadratic equations and inequalities (9.2.4.1).*
- *Recognize that to solve certain equations, number systems need to be extended from whole numbers to integers, from integers to rational numbers, from rational numbers to real numbers, and from real*

*numbers to complex numbers. In particular, non-real complex numbers are needed to solve some quadratic equations with real coefficients (9.2.4.3).*

## Content Weaknesses

The phrase "using efficient and generalizable procedures based on knowledge of place value, including standard algorithms" appears repeatedly in standards on the addition, subtraction, multiplication, and division of whole numbers (grades 3 and 4), as well as decimals and fractions (grades 5 and 6). However, students are not expected to know the standard algorithm for these operations.

In a number of places, the Minnesota Mathematics Standards K–12 lack coherence. For example, consider the following sixth-grade standard:

> *Determine greatest common factors and least common multiples. Use common factors and common multiples to calculate with fractions and find equivalent fractions (6.1.1.6).*

This standard might make sense if it were part of a clearly articulated progression. However, there is no reference to the use of the "greatest common factor" or the "least common multiple" at any other grade level. Furthermore, the use of these number theory concepts to develop students' understanding of operations with fractions is dated. More recent pedagogy builds on the use of foundational experiences with equivalent fractions as a strategy for adding and subtracting fractions, and on prior understandings of multiplication and division when multiplying and dividing fractions.

Another example of lack of coherence appears in the fourth grade relative to arithmetic. Specifically, one benchmark expects students to "estimate products and quotients of multi-digit whole numbers by using rounding, benchmarks and place value to assess the reasonableness of results" (4.1.1.4). This expectation is difficult to comprehend without specific context connecting it to its accompanying standard (4.1.1), which involves multiplying multi-digit numbers (not both multiplying and dividing as implied in the benchmark), and solving real-world and mathematical problems using arithmetic.

At the fifth-grade level, students are expected to "Add and subtract fractions, mixed numbers and decimals to solve real world and mathematical problems" (5.1.3), by reaching conceptually-driven benchmarks such as the following:

> *Model addition and subtraction of fractions and decimals using a variety of representations. For example: Represent 2/3 + 1/ 4 and 2/3 – 1/4 by drawing a rectangle divided into 4 columns and 3 rows and shading the appropriate parts or by using fraction circles or bars (5.1.3.2).*

However, not all standards include benchmarks that develop conceptual understanding. For example, consider the following sixth-grade standard:

> *Multiply and divide decimals, fractions, and mixed numbers; solve real-world and mathematical problems using arithmetic with positive rational numbers (6.1.3).*

In this case, the associated benchmark reads:

> *Calculate the percent of a number and determine what percent one number is of another number to solve problems in various contexts. For example: If John has $45 and spends $15, what percent of his money did he keep? (6.1.3.3).*

Unfortunately, the example word problem in this benchmark does not provide conceptually-driven suggestions or representations that would help students in comprehending what they are being asked to do. Given the importance of fractions and decimals at these grade levels, such a lack of consistency regarding developing conceptual understanding is concerning.

In addition to these weaknesses, it is not at all clear if the standards writers have a different view of mastery and fluency. For example, a second-grade standard expects students to "Demonstrate mastery of addition and subtraction basic facts" (2.1.2). However, a related benchmark expects them to "Demonstrate fluency with basic addition facts and related subtraction facts" (2.1.2.2).

Other weaknesses in Minnesota's content standards include the following:

- Certain first- and third-grade standards (specifically, 1.2.2 and 3.2.2) ask students to "Use number sentences…" but do not consider the full variety of problem situations for addition, subtraction, multiplication, and division (e.g. for addition and subtraction: result unknown, change unknown, start unknown; for multiplication and division: unknown product, group size unknown, number of groups unknown).

- The treatment of transformational geometry is inconsistent. Although translations, reflections, and rotations are introduced in fourth grade (4.3.3), transformational geometry receives only one benchmark mention at the high school level (9.3.4.6), when it is typically given greater attention.
- The approach to instruction involving angles and angle measurement (which is only covered in grade 4 and never defined) is both limited and dated. For example, fourth-grade students are to "Measure angles in geometric figures and real-world objects with a protractor or angle ruler" (4.3.2.1) and "Compare angles according to size. Classify angles as acute, right, and obtuse" (4.3.2.2). Interactive technology (not only tangible tools like protractors) is obviously now being used to great effect in the teaching of geometry. Additionally, instruction involving angles and angle measurement should extend to the middle grades (6–8) and include supplemental, complementary, vertical, and adjacent angles and other topics involving angles and angle measure.
- In many places, the standards devote an inordinate amount of attention to technology-related tools and their applications. For example, students in seventh grade are expected to "Understand that calculators and other computing technologies often truncate or round numbers" (7.1.2.3). Devoting an entire standard or benchmark to such expectations is overkill.

Finally, although the introduction to the standards notes that mathematical knowledge is "acquired through the processes of problem solving, reasoning and proof, communication, connections, and representation," these processes are never fully articulated, much less explicitly connected to the content standards. Although there is some reference to problem solving at the standard level, and to reasoning and representations at the benchmark level, there is no explicit plan for engaging all five of the processes.

# Communication

Though somewhat dated, the Minnesota Mathematics Standards are, for the most part, well written and accessible. However, when it comes to implementation, they provide teachers with very little guidance.

## + Communication Strengths

In general, the examples provided for each benchmark seem useful for teachers and parents, as demonstrated by the following third- and sixth- grade benchmarks:

- *Understand that the size of a fractional part is relative to the size of the whole. For example: One-half of a small pizza is smaller than one-half of a large pizza, but both represent one-half (3.1.3.2).*
- *Represent real-world or mathematical situations using equations and inequalities involving variables and positive rational numbers. For example: The number of m miles (m) in a kilometer (k) race is represented by the equation m = 0.62 k (6.2.3.1).*

## – Communication Weaknesses

Perhaps the biggest communication weakness is the absence of explicit guidance regarding the actual implementation of the Minnesota Mathematics Standards. In particular, although the standards are presented by grade level and content strand, with accompanying benchmarks, it is not at all clear how they work together instructionally. Are the standards to be implemented in order by content strand? Is there some intersection between particular standards? For instance, would a second-grade teacher begin teaching with the Number & Operation strand (2.1.1) and continue from benchmark 2.1.1.1 in Number & Operation through 2.3.3.2 in Geometry & Measurement?

This problem is even more serious at the high school level, where there is no indication of how the grade 9–11 standards are to be organized into courses or sequenced within courses. More specifically, all of the standards in grades 9, 10, and 11 are combined and presented as cross-grade level standards for these grades. They are each initially coded with a 9, implying that the standards may be presented at varying stages within the 9–11 grade band.

Compounding this problem is the lack of introductions for grade levels or bands, and likewise for content strands or topics at the high school level (grades 9–11). This is a major concern, since such introductions indicate the mathematics topics that teachers are expected to focus on.

Although the state of Minnesota only requires high school students to complete three credits of mathematics, ancillary materials explain that "it is highly important that high school students take a mathematics course, or a course that is rich in the usage of mathematics, during each high school year, including twelfth grade." These materials also include a list of possible grade 12 mathematics courses.[5] Yet, standards are not provided for this grade 12 mathematics experience.

Finally, there is no glossary.

# Recommendations

1. Provide introductions that articulate the mathematical focus for each grade level or course.
2. Address the concerns raised regarding the lack of coherence.
3. Define the role of the processes within the standards, and articulate this for each grade level or course.
4. Develop guidance on how grade 9–11 standards are to be organized into courses.
5. Consider providing mathematical content standards for "fourth year" or grade 12 courses such as Precalculus and AP Statistics.
6. Clarify how the content strands, standards, and benchmarks are aligned and sequenced so that teachers know how to implement them.
7. Revise the Minnesota Mathematics Standards soon. By the time they are scheduled to be revised (2021-2022), they will have been in place for over fifteen years.

## Bottom Line

Significant revisions recommended. Standards should not be implemented until and unless these revisions are made.

## Documents Reviewed

*Minnesota K–12 Academic Standards in Mathematics*, accessed from http://education.state.mn.us/MDE/dse/stds/Math/ (also includes extensive online resources, including: "Frequently Asked Questions about the 2007 Minnesota Mathematics Standards" and "Benchmarks for Grades K–12.")[6]

## Endnotes

1. Carmichael, Sheila, Kathleen Porter-Magee, Gabrielle Martino, and W. Stephen Wilson. *The State of State Standards—and the Common Core—in 2010*. Thomas B. Fordham Institute (Washington, DC: July 2010), https://edexcellence.net/publications/the-state-of-state-of-standards-and-the-common-core-in-2010.html.
2. See *Frequently Asked Questions about the 2007 Minnesota Mathematics Standards and Benchmarks for Grades K–12,* http://education.state.mn.us/mdeprod/idcplg?IdcService=GET_FILE&dDocName=005246&RevisionSelectionMethod=latestReleased&Rendition=primary.
3. Ibid.
4. These processes were originally proposed in the National Council of Teachers of Mathematics' *Principles and Standards for School Mathematics* (NCTM, 2000).
5. See *Frequently Asked Questions about the 2007 Minnesota Mathematics Standards and Benchmarks for Grades K–12*.
6. Although the additional resources are referenced, they are not a part of Minnesota's final rating.

Mathematics

# Missouri

10 9 **Strong**

*Recommend focus on the implementation of these standards.*

8 7 **Good**

*Targeted revisions recommended along with a focus on implementation of these standards.*

6 5 **Weak**

***Significant revisions recommended. Standards should not be implemented until and unless these revisions are made.***

4 3 2 1 **Inadequate**

*Complete revision highly recommended. Standards have critical shortcomings and should not be implemented.*

## Overall Rating: Weak (5/10)

Content (4/7) + Communication (1/3)

## Overview

The Missouri Learning Standards (MLS 2016) follow a coherent progression, and are generally rigorous and focused. However, they are missing a number of essential elements that are common to other states. In particular, they do not include mathematical practice or process standards. And there are no overviews or lists of expected subtopics at the start of each grade or course. Finally, there are no clarifying examples whatsoever within the content standards, making them unusually vulnerable to misinterpretation. As a result of these gaps, the MLS 2016 provide a weak foundation for developing conceptual understanding, mathematical habits of mind, and rigorous instruction.

## General Organization

MLS 2016 is a major revision of MLS 2010, and the new standards are significantly shorter than the old ones. For example, the latest revisions reduced the word count for the K–8 content standards by about 40 percent. Furthermore, there is no introduction or preamble to the MLS 2016, nor is there an overview of the content focus for each grade (or course). And there are no process or practice standards.

Additional Resources include *Math Crosswalks* (comparing each level of MLS 2016 with MLS 2010) and a 2008 draft of a *Mathematics Glossary*, as well as a set of grade- and course-level *Expanded Expectations* that can be accessed through a separate location on the MO DESE website. Since the MLS 2016 does not specifically reference the *Expanded Expectations*, they were not reviewed for this report.

The MLS 2016 are divided between standards for grades K–5 and standards for grades 6–12, with the former presented as a six-column table (with one column per grade level) and the latter presented in three tables: one for grades 6–8, and one for the Algebra I and Algebra II, and one for Geometry.

# Content

Although the math underlying the MLS 2016 is sound, the revisions to MLS 2010 resulted in the removal of critical content, including the standard algorithms for the four operations, as well as numerous passages that are critical to conceptual development (especially in fractions) or the interpretation of the standards (including all clarifying examples). In addition to these weaknesses, there are no practice standards, and the mathematical glossary is subpar.

## + Content Strengths

The MLS 2016 follow a logical progression from kindergarten through twelfth grade. And in some places, they represent an improvement over the 2010 standards. For example, both of the following Algebra II clusters are useful additions:

- *Extend and use the relationship between rational exponents and radicals (A2.NQ.A).*
- *Define and use logarithms (A2.SSE.A).*

Similarly, a number of useful milestones have been added as explicit expectations. For example:

- *Count backward from a given number between 10 and 1 (K.NS.A.3).*
- *Convert decimals to fractions and fractions to decimals (5.NF.A.2).*
- *Extend prior knowledge to generate equivalent representations of rational numbers between fractions, decimals and percentages (limited to terminating decimals and/or benchmark fractions of 1/3 and 2/3) (6.NS.C.8).*
- *Divide polynomials by monomials (A1.APR.A.2).*

## – Content Weaknesses

As a result of the aforementioned revisions, MLS 2016 suffers from several important and unnecessary weaknesses. For example, although expectations of computational fluency are articulated in appropriate grades—through the consistent use of the phrase "demonstrate fluency"—the aforementioned revisions removed all references to computational algorithms.[1] This is a serious oversight, since to compute efficiently, every student must know the standard algorithms for addition, subtraction, multiplication, and division.

In many places, the brevity of MLS 2016 is problematic. For example, consider what striking the last four words does to the following standard:

> *Compare two different proportional relationships ~~represented in different ways~~ (8.EEI.B.5b).*

The whole point of this standard is that students should be able to recognize and then compare proportional relationships regardless of how they are presented: in a table, as an equation, graphically, or with words. Hence, the revised standard is meaningless.

As these examples illustrate, in too many places, important language that was optimized for conceptual development was deleted as a result of the 2016 revisions. This problem is particularly acute when it comes to fractions, as demonstrated by the following example:

> *~~Understand a fraction as a number on the number line~~; represent fractions on a number line ~~diagram~~ (3.NF.A.3).*

Typically, fractions are established and understood as numbers first and then further developed through various representations of these numbers—on a number line, as part of a region (or whole), and as part of a set (or collection of objects). Yet none of this conceptual development is included in the MLS 2016. Similarly, the addition of fractions with unlike denominators is rushed, thanks to the deletion of the following MLS 2010 standards:

- *Express whole numbers as fractions, and recognize fractions that are equivalent to whole numbers. Examples: Express 3 in the form 3 = 3/1; recognize that 6/1 = 6; locate 4/4 and 1 at the same point of a number line diagram (MLS 2010 3.NF.A.3c).*

- *Add and subtract mixed numbers with like denominators, e.g., by replacing each mixed number with an equivalent fraction, and/or by using properties of operations and the relationship between addition and subtraction (MLS 2010 4.NF.B.3c).*

Instead of this careful development, MLS 2016 presents only the following abrupt expectation:

> *Solve problems involving adding and subtracting fractions and mixed numbers with like denominators (4.NF.B.6).*

In a similar vein, MLS 2016 does not use the relationship between the multiplication and division of whole numbers to develop the conceptual understanding required for the division of fractions. Nor is the division of fractions developed properly in grades 5–6. Again, the final expectation is presented abruptly:

> *Compute and interpret quotients of positive fractions. Solve problems involving division of fractions by fractions (6.NS.A.1a).*

In some places, entire standards have simply been deleted. For example, the high school geometry standards in MLS 2016 define congruence in terms of rigid motions (or transformations) and then use that definition to develop the criteria for triangle congruence (ASA, SAS, and SSS)—an approach that is new for many high school teachers. Yet MLS 2016 dropped several standards that were critical to the development of transformation-based geometry.

As illustrated by several of the quoted standards, throughout the MLS 2010 content standards, examples are often used to clarify expectations, or to express minimum expectations by listing the things that students must know. Clearly, such examples were not intended to limit what teachers could do instructionally. Nevertheless, all of the clarifying examples and lists in MLS 2010 were removed when the standards were revised—with undesirable consequences. For example, consider the following Algebra I standard:

> *Using tables, graphs and verbal descriptions, interpret key characteristics of a function that models the relationship between two quantities (A1.IF.B.3).*

According to MLS 2010, key features of functions include: "intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity" (MLS 2010 HSF-IF.B.4). Yet this helpful and important list was deleted in the 2016 revisions.

Similarly, consider the following (revised) Algebra II standard:

> *Identify zeros of polynomials when suitable factorizations are available, and use the zeros to sketch the function defined by the polynomial (A2.APR.A.5).*

Because this revised standard only mentions polynomials and does not include examples of other non-linear functions (which were included in the deleted 2010 standard HSF-IF.C.7) the following elements have been left out: the graphing and interpretation of square root, cube root, and piecewise-defined functions, including step functions and absolute value functions; (the graphing of) exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.

Finally, consider the following six-word Algebra 2 standard:

> *Translate between equivalent forms of functions (A2.IF.A.2).*

To even begin to grasp the intent of this standard in its revised form, readers must track down the corresponding MLS 2010 standard:

> *For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity (MLS 2010 HSF-IF.B.4).*

In addition to the problems with the content standards, MLS 2016 does not address mathematical practices or processes—that is, mathematical habits of mind that mathematics educators at all levels should seek to develop in their students. Furthermore, Missouri's mathematics glossary contains several incorrect definitions,[2] as well as a number of non-mathematical (and sometimes peculiar) items such as "referent," "shape of data," and "close to doubles."

# Communication

Although the underlying math is generally sound, the brevity of the standard statements in the MLS 2016 precludes the sort of clarity and specificity exhibited by top-notch standards.

## + Communication Strengths

In many cases, the language in the Algebra I and Algebra II standards of the MLS 2016 is precise, and the topics and expectations progress logically, as illustrated by the following standards:[3]

- *Represent constraints by equations or inequalities and by systems of equations or inequalities, and interpret the data points as a solution or non-solution in a modeling context (A1.CED.A.3).*
- *Create and solve equations and inequalities, including those that involve absolute value (A2.REI.A.1).*
- *Create and solve systems of equations that may include non-linear equations and inequalities (A2.REI.B.3).*

## − Communication Weaknesses

As noted above, the removal of examples and other text in the standards revisions process has often undermined the clarity and specificity of some standards to the point that they no longer communicate what they should. For example, consider the following Algebra I standard:

> *Analyze the effect of translations and scale changes on functions (A1.BF.A.1).*

This standard is concise. However, it lacks specific details that most teachers are likely to need. Teachers can and would use the additional details in the 2010 version of this standard:

> *Identify the effect on the graph of replacing f(x) by f(x) + k, k f(x), f(kx), and f(x + k) for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them (HSF-BF.B.3).*

It should be noted that the *Expanded Expectations*[4] documents (MLS EE) often include additional details. However, the MLS 2016 does not specifically reference these documents, and it's unclear if or how Missouri math teachers know about or use them.

In some cases, the MLS EE restore the deleted statements that were in the original MLS 2010. Still, without some sort of link to the MLS EE, too many of the 2016 standards are vague, cryptic, and difficult to understand, as demonstrated by the following standards:

- *Interpret products of whole numbers (3.RA.A.1).*
- *Interpret quotients of whole numbers (3.RA.A.2).*
- *Use angle properties to write and solve equations for an unknown angle (7.GM.B.5).*
- *Identify and/or compute the constant of proportionality (unit rate) (7.RP.A.2b).*
- *Prove theorems about lines and angles (G.CO.C.8).*
- *Prove theorems about triangles (G.CO.C.9).*
- *Prove theorems about polygons (G.CO.C.10).*

In addition to this structural weakness, the MLS 2016 also lack a number of helpful features that are common to other state standards, including introductions for individual grade levels (or courses) that list the major topics that teachers ought to focus their attention on.

# Recommendations

1. Restore or replace the clarifying examples from MLS 2010 to reduce confusion and fully define the intent of the revised standards.
2. Provide additional detail in selected standards to help K–12 teachers develop students' conceptual understanding—especially in the grades 3–6 standards on fractions.
3. Revise the K–6 standards on addition, subtraction, multiplication, and division so they explicitly reference the standard algorithms for each of these operations.
4. Adopt practice or process standards to help teachers foster students' mathematical habits of mind.
5. Include an *Overview of Missouri Learning Standards* and a summary of the Content Focus for each grade (or course).
6. Clean up the Expanded Expectations and explicitly link it to the Missouri Learning Standards.[5]
7. Update and improve the glossary.

## Bottom Line

Significant revisions recommended. Standards should not be implemented until and unless these revisions are made.

## Documents Reviewed

*Missouri Learning Standards* (MLS 2016), accessed from https://dese.mo.gov/college-career-readiness/curriculum/missouri-learning-standards#mini-panel-mls-standards2.

## Endnotes

1. See 3.RA.C.7, K.RA.A.2, 1.RA.C.8, 2.RA.A.1, 2.NBT.B.6, 3.NBT.A.3, 3.RA.C.8, 4.NBT.A.5, 6.NS.B.2, 6.NS.B.3.
2. For example: multiple is defined as "the product of a whole number and any other whole number," and prism is defined as "a 3-dimensional figure in which all of the surfaces are polygons."
3. Other examples can be found in 7.EEI.B.4, A1.NQ.B.3, A1.CED.A.4, A1.REI.B.5, and A1.IF.A.1.
4. See https://dese.mo.gov/college-career-readiness/curriculum/mathematics/expanded-version-mathematics-grade-and-course-level.
5. In the Expanded Expectations document, there are numerous instances where the original and expanded versions are the same. In these cases, we recommend that the expanded version be left blank or labeled as "No expanded expectations for this standard" to signify "no additional information." As it stands, readers have to examine both versions carefully to determine if there is any difference between them.

Mathematics

# Nebraska

10 9 **Strong**

*Recommend focus on the implementation of these standards.*

8 7 **Good**

*Targeted revisions recommended along with a focus on implementation of these standards.*

6 5 **Weak**

***Significant revisions recommended. Standards should not be implemented until and unless these revisions are made.***

4 3 2 1 **Inadequate**

*Complete revision highly recommended. Standards have critical shortcomings and should not be implemented.*

## Overall Rating: Weak (5/10)

Content (3/7) + Communication (2/3)

## Overview

Nebraska's elementary math standards are sound, well paced, and appropriately focused on numeracy and arithmetic. However, in the higher grade levels, the pacing becomes too slow. For example, functions, which are often introduced in eighth grade, are deferred until high school. And the high school standards are uneven, with some topics treated too briefly and others that should be treated earlier deferred to an optional grade 12 Advanced Topics course. In addition to these weaknesses, the process standards are brief and poorly developed. Overall, the Nebraska standards are less detailed, coherent, and demanding than most states' standards, making them a weak foundation for a good mathematics curriculum.

## General Organization

The Nebraska math standards are presented in two formats: vertical and horizontal. In the vertical format, standards are arranged by grade in K–8, with a single set of standards for grades 9–11, plus optional grade 12 standards on "Advanced Topics" that are recommended for students who plan on attending college. In the horizontal format, standards are grouped into four categories or "strands"—Number, Algebra, Geometry, and Data—which are further divided into subcategories. (For example, Geometry is divided into Characteristics, Coordinate Geometry, and Measurement.) In the horizontal format, each of these subcategories is presented on a separate page, and includes standards from multiple grade levels. In the vertical format, these categories and subcategories are also used to organize standards within grade levels.

In addition to the content standards, both the vertical and the horizontal documents include four Mathematical Processes: *solves mathematical problems*; *models and represents mathematical problems*; *communicates mathematical ideas effectively*; *and makes mathematical connections*.

# Content

Nebraska's content standards are focused and rigorous in grades K–5. However, starting in sixth grade, they begin to drop off the pace set by other states, and by eighth grade they are significantly behind. In addition to this weakness, the content standards are insufficiently detailed, especially for grades 9–11. And they sometimes lack coherence due to organizational problems. Finally, the Mathematical Process standards are brief and poorly developed.

## + Content Strengths

The Nebraska standards do a good job at the elementary level, where they rightly focus on numeracy and arithmetic, including a solid development of place value and the four operations for positive whole numbers. Fluency is properly and helpfully defined as "automatic recall based on understanding" (MA 0.1.2.a), and students are expected to "fluently multiply and divide within 100" (MA 3.1.2.g) and to use the standard algorithms for addition, subtraction, multiplication, and division (MA 2.1.2.b; MA 4.1.2.a–c; MA 5.1.2.a–b; MA 6.1.2.c–d). Fractions are also well developed, starting in third grade, and are helpfully connected to the number line. Finally, topics in algebra, geometry, and data are also treated in suitable depth. For example, angles are introduced in fourth grade, and the first quadrant of the Cartesian plane is introduced in fifth grade. Appropriately, there are considerably more standards on numeracy, so these other topics do not distract from the key goal of developing a solid foundation in numbers and operations.

In the middle grades, the standards are for the most part suitably detailed and logically cohesive, if somewhat less demanding than in other states. Students are asked to add, subtract, multiply, and divide decimals using the standard algorithm in grade 6. The key topics of rates, ratios, and proportions are developed in grades 6–8. And probability is developed extensively in grade 7, which includes standards about dependent compound events and both theoretical and experimental probability.

Finally, although they lack detail in many areas (see below), the standards for grades 9–11 include most of the important topics for these grades, including functions, plane geometry, and reasoning from data. Similarly, the (optional) grade 12 standards include vectors, matrices, trigonometry, and additional topics in probability and data—material that is highly useful for quantitative college majors.

## – Content Weaknesses

The Nebraska standards exhibit weaknesses in four critical areas: pacing, coherence, the development of conceptual understanding, and the mathematical processes.

Though generally strong at the elementary level, Nebraska's standards begin to decrease in pace as the grade level increases. And the standards for grades 8–12 are particularly weak. For example, linearity and functions—two key topics that are usually covered in eighth grade—are deferred to later grades, as are the proof and the converse of the Pythagorean Theorem. And in the grade 9–11 standards, a substantial number of familiar topics are again omitted or deferred, including exponential, logarithmic, and trigonometric functions.

The Nebraska standards fail to support coherence in multiple ways. For example, they do not contain introductory statements for a given grade that lay out the foci or key goals for that grade. And the same mathematical topic sometimes appears in multiple categories or subcategories. For example, standards concerning ratio and rate are found in the subcategories on Numeric Relationships, Algebraic Processes, and Applications in grade 6, and in Operations in grade 7. Similarly, the treatment of proportional relationships—another key topic in the middle grades—lacks coherence due to this structure.

In addition to these organizational problems, some content choices limit coherence. For example, too little attention is devoted to developing an understanding of fractions (and especially the role of unit fractions). And the fourth-grade standard MA 4.1.1.i asks students to "generate and explain equivalent fractions by multiplying by an equivalent fraction of 1" when they have not yet learned how to multiply fractions. Similarly, lines of best fit are introduced in eighth grade, before lines themselves have been treated in detail. And exponential functions are mentioned in the eleventh-grade modeling standard MA 11.2.3, although they are not formally introduced until twelfth grade (MA 12.2.1.a).[1] (Also, completing the square is not mentioned explicitly.)

Because they rarely ask students to explain their reasoning, Nebraska's standards often give the impression that procedural fluency is more important than conceptual understanding (when, in fact, both are equally critical). Tellingly, for example, the word "understand" does not appear in the standards for grades 4–11, and the word "explain" occurs only once in each of grades 5–8. This gap appears in important topics. For example, in third grade, the distributive property is mentioned (MA 3.2.2.a), but there is no indication that it is to be understood and explained. Similarly, students are expected to compute with positive integer exponents (grades 5 and 6), all integer exponents (grade 8), and rational exponents (grades 9–11). But at no point do the standards mention the laws of exponents, or the connection between these laws and the definition of raising to a negative or fractional power.

In addition to these weaknesses, the Nebraska Mathematical Process standards are briefer and less comprehensive than either the process standards provided by the National Council of Teachers of Mathematics (NCTM) or the CCSS-M practice standards. For example, the NCTM process standard on Reasoning and Proof includes a list of related mathematical processes for use in instructional programs from pre-K–12. However, Nebraska's process standards contain only one (oblique) reference to proof, in a single standard on communication. ("Students will critique the reasoning of others as well as provide mathematical justifications.") And there are no specific instructions in the process standards concerning their integration with the content standards.

# Communication

In general, the Nebraska standards are clearly written. However, in some places the content standards are lacking in specifics, especially in grades 9–11 (where their grain size varies dramatically). Similarly, the process standards lack detail.

## + Communication Strengths

In general, the vertical standards for grades K–8 communicate the main performance goals well, as do the Advanced Topics standards for grade 12. Similarly, the horizontal standards allow teachers to see how a mathematical topic located in a specific subcategory of the standards develops across grade levels.

## – Communication Weaknesses

Nebraska's K–8 standards are terse. And its standards for grades 9–11 are insufficiently detailed—mentioning key topics rather than providing thorough information about them. Consequently, in some cases the content standards fail to communicate explicit expectations for what students should understand and be able to do. For example, students in first grade are expected to "add within 100...using concrete models, drawings and strategies which reflect understanding of place value" (MA 1.1.2.e). However, there is no mention of knowing the process of composing a ten ("carrying"), or of explaining the reasoning used.

In a similar vein, a few standards are unclear because they lack examples. For instance an eleventh-grade standard (MA 11.2.2.b) expects students to "identify and explain the properties used in solving equations and inequalities," and an eighth-grade standard (MA 8.1.1.d) asks them to "...order real numbers both off and on the number line." And a few standards are just poorly worded. For example, another eighth-grade standard (8.2.1.c) expects students to "describe equations and linear graphs as having one solution, no solution, or infinitely many solutions," but the word "solutions" pertains to equations, not graphs of functions.

In grades 9–11, the amount of the material covered varies greatly from standard to standard. For example, high schoolers are expected to "prove geometric theorems about angles, triangles, congruent triangles, similar triangles, parallel lines with transversals, and quadrilaterals using deductive reasoning" (MA 11.3.1.b). In contrast, a subsequent standard (MA 11.3.2.a) asks students to "derive and apply the midpoint formula." (Standard MA 11.3.1.b is also vague because it does not specify the geometric theorems to be taught.)

Finally, the standards for grades 9–11 are not organized into courses, and it would take considerable effort for educators to do this for themselves.

# Recommendations

1. Add missing content and increase the pacing for grades 8–12. In particular, add functions and linearity to the eighth-grade curriculum and exponential and other functions to grades 9–11.
2. Organize the standards for grades 9–11 into courses.
3. Provide introductions and curricular foci for each grade in K–8 and each course or year of high school.
4. Reorganize the standards so that closely related parts of the same topic are not spread across multiple categories.
5. Split any vague or overly broad standards into clearer, more detailed standards.
6. Revise the middle school standards so they treat proportional and linear relationships more thoroughly and coherently.
7. Put more emphasis on conceptual understanding by adding standards that use words like "understand" and "explain."
8. Bolster the Mathematical Processes so they are more comprehensive and explicitly support the development of mathematical reasoning and proof. Indicate that these standards should be integrated with the content standards.
9. Consider creating a "coherence map" to promote coherence across grade levels and topics.[2]

## Bottom Line

Significant revisions recommended. Standards should not be implemented until and unless these revisions are made.

## Documents Reviewed

*Nebraska's College- and Career-Ready Standards for Mathematics* (2015), accessed from https://www.education.ne.gov/math/index.html.

## Endnotes

1. Similarly, normal distributions are introduced in grade 11, but since exponential functions have not been developed, any treatment of them must be limited.
2. For example, see this "coherence map" at https://achievethecore.org/coherence-map/.

Mathematics

# North Carolina

10 9 **Strong**

*Recommend focus on the implementation of these standards.*

8 7 **Good**

*Targeted revisions recommended along with a focus on implementation of these standards.*

6 5 **Weak**

***Significant revisions recommended. Standards should not be implemented until and unless these revisions are made.***

4 3 2 1 **Inadequate**

*Complete revision highly recommended. Standards have critical shortcomings and should not be implemented.*

## Overall Rating: Weak (6/10)

Content (5/7) + Communication (1/3)

## Overview

For the most part, the North Carolina Standards are focused and coherent. There is an appropriate emphasis on arithmetic in the early grades. Geometry, algebra, and statistics are well developed from their middle school foundations through high school. And there is an appropriate balance between procedural fluency, conceptual understanding, and the interpretation of results and expressions in real-world contexts. At the same time, there are some problems with rigor, including counterproductive limitations on arithmetic in the early grades. And the wording of some standards is vague, particularly at the high school level. Finally, the standards are inaccessible due to their scattered presentation and the omission of important information about the progression of the critical areas and the practice standards.

## General Organization

The North Carolina Math Standards are organized by grade at the elementary and middle school levels and by course at the high school level. The first high school course, Math I, focuses on algebra and functions involving linear, quadratic, and exponential expressions, as well as coordinate geometry and bivariate data. The second course, Math II, focuses on congruence, similarity, and Euclidean geometry, while extending the work on quadratics and power functions (in algebra) and introducing conditional probability and bivariate categorical data (in statistics). Finally, Math III extends the focus on geometry, but also includes work with more advanced functions, such as logarithmic and trigonometric functions, as well as statistical inference.

Although the structure of the standards is never explicitly discussed, related standards are organized into clusters that are (in turn) grouped under various domains. These domains progress appropriately with grade level. (For example, "Number and Operation in Base 10" spans grades K–5, while "The Number System" and "Ratios and Proportional Relationships" are domains in grades 6–8.)

North Carolina's eight Standards for Mathematical Practices are identical to those in the CCSS-M. However, there is no additional information in the state's content standards that explains the meaning or role of the Practice Standards.

This review focuses on the standards required of all students: the K–8 standards and those in the two high school sequences of three courses. (A fourth-year mathematics course is also part of the high school graduation requirements. However, there is no single, unified set of standards for this final year, and the content and level of the courses that satisfy this requirement vary widely depending on students' projected paths.)

# Content

North Carolina's standards are, for the most part, focused and coherent. However, there is room for improvement when it comes to the level of the arithmetic expectations, and a few other topics could be presented more coherently.

## + Content Strengths

In the early grades, the North Carolina standards rightly focus on arithmetic, and there are clear expectations for mastery of operations via the standard algorithms, as well as a notable emphasis on conceptual understanding. For example, consider the following fifth-grade standard, which highlights how students should make sense of the algorithm for long division:

> *Find quotients with remainders when dividing whole numbers with up to four-digit dividends and two-digit divisors using rectangular arrays, area models, repeated subtraction, partial quotients, and/or the relationship between multiplication and division. Use models to make connections and develop the algorithm (5.NBT.6).*

The focus on concept as well as computation continues through the grades. For example, consider the following seventh-grade standard:

> *Understand the mean absolute deviation of a data set is a measure of variability that describes the average distance that points within a data set are from the mean of the data set (7.SP.3.A).*

This standard includes a specific expectation that students understand the concept of mean absolute deviation, in addition to knowing how to compute it.

Throughout the standards, there is also a consistent emphasis on application, interpretation, and modeling in real-world contexts, as demonstrated by the following seventh-grade standard:

> *Understand that equivalent expressions can reveal real-world and mathematical relationships. Interpret the meaning of the parts of each expression in context (7.EE.2).*

In general, the progression of topics is coherent across grade levels. For example, in geometry, students learn the definition of congruence in terms of rigid motions in middle school and then use it to justify the triangle congruence criteria in high school:

> *Use congruence in terms of rigid motion. Justify the ASA, SAS, and SSS criteria for triangle congruence. Use criteria for triangle congruence (ASA, SAS, SSS, HL) to determine whether two triangles are congruent (M2.G–CO.8).*

In the geometry courses, expectations for what results students will prove are explicit and rigorous. For example, standard M2R.G–CO.9 states that students will prove theorems such as "vertical angles are congruent." Again, there is a focus on justifying reasoning, both in algebraic and geometric settings, as demonstrated by the following Math III standard:

> *Justify a solution method for equations and explain each step of the solving process using mathematical reasoning (M3.A–REI.1).*

In general, the organization of North Carolina's high school standards seems designed to build connections between topics. For example, in Math I, where the focus is primarily on algebra and functions with linear, quadratic, and exponential expressions, the geometry standards deal with algebraic proofs of geometric results, and most of the statistics standards pertain to fitting these types of functions to bivariate data. (Such connections and progressions are well-explained in supplementary Instructional Resources for the standards, but these are neither easy to access nor necessarily updated.)

## Content Weaknesses

At the elementary level, the limitations put on arithmetic are a major weakness. For example, the capstone standard algorithm for multiplication (5.NBT.5) only deals with the multiplication of three-digit numbers by two-digit numbers. Similarly, fraction arithmetic only involves denominators of 2, 3, 4, 5, 6, 8, 10, 12 and 100 through fifth grade. While it is potentially useful to start with small denominators, as students progress this becomes an artificial limitation. Furthermore, it is not clear in the standards when mastery with any size denominator is expected. (Presumably, this is an implicit expectation of the seventh-grade standards on rational number arithmetic. However, it is never explicitly required.)

Other fundamental standards related to fractions are also unclear. For example, consider the following third-grade standard:

> *Using a number line, explain that the numerator of a fraction represents the number of lengths of the unit fraction from 0 (3.NF.2) .*

This standard only describes the role of the numerator, but not how to think about the fraction itself as a point on the number line.

In addition to these issues, there are also some notable inconsistencies. For example, students are expected to memorize single-digit facts for multiplication but not for addition. And the concept of volume is introduced in full generality in grade 5 (5.MD.4), while the concept of area is only introduced in the context of rectangles in grade 3 (3.MD.5), creating the potential for misconceptions about the meaning of area as an attribute of two-dimensional figures.

Work with data is not over-emphasized in the early grades. However, there are some missed opportunities when it comes to explicitly connecting these topics to the development of arithmetic with non-whole numbers.

Similarly, at the middle school level, there are coherence issues when it comes to the concept of slope, which is first developed in the context of ratios and proportional relationships. Unfortunately, the concepts of unit ratio, unit rate, and slope are never explicitly connected in the relevant standards (6.RP.2, 7.RP.1, 8.F.4.).

At the high school level, the content is generally coherent and rigorous, though not always clearly worded (see *Communication*). However, a few standard college-preparatory topics are not included, such as arithmetic of complex numbers, counting arguments, and geometric constructions. So overall, the content of these courses is slightly less advanced than the content in many other states' high school standards.

Last but not least, the meaning and role of the practice standards is not at all clear because they are never "unpacked" in the relevant content standards. Some of these practices are implicit in the many standards that ask students to "interpret," "justify," "model," and "explain reasoning." However, they need to be made much more explicit if they are to be useful to teachers and students.

# Communication

The K–8 content standards are, for the most part, specific and clear about the expectations for students. However, many high school standards (and especially those added since 2010) are poorly worded. And the absence of any information about the overall structure of the standards is a major weakness.

## Communication Strengths

One of the main communication strengths of the standards is their specificity, which is generally consistent regardless of the grade or topic. For example, the second-grade standard 2.OA.1 ("Represent and solve addition and subtraction word problems...") specifies the types of problems and level of complexity. Similarly, at the high school level, the Math 2 standard M2.G-CO.9 ("Prove theorems about lines and angles and use them to prove relationships in geometric figures") includes a list of five specific results that students are expected to prove.

## Communication Weaknesses

Perhaps the biggest communication weakness is that the standards are not presented as a coherent whole. Specifically, the K–8 standards documents are presented in one file, and the Math I, II, III are presented in three separate documents. Yet none of these documents includes an explanation of the standards' structure (e.g., what is a cluster, domain, etc.), the role of the practice standards, or how topics and concepts progress through the grade levels. This type of information is available in supporting documents in the Instructional Resources section. However, while these appear to be useful resources, they are not part

of the standards themselves and thus may not be updated to reflect changes to the standards. Furthermore, they are not in a condensed form. For example, for the K–8 standards, each grade level has a standards document that includes the critical areas for the grade level, a separate one-page document with the "major emphases of the grade," and a document "unpacking the standards" that includes additional information and examples for individual content standards, as well as as grade-specific examples of mathematical practices. This fragmented approach makes it difficult for teachers, curriculum writers and other stakeholders who want to see the big picture.

The other major communication weakness is the vagueness of some standards, especially in the higher grades. For example, the definition of congruence provided in standard 8.G.2 suggests that students "verify experimentally the properties of rotations, reflections, and translations that create congruent figures." However, it is not clear whether these properties are meant to be general (e.g., the preservation of length), specific to each type of transformation, or both.

This problem is also evident in the following Math 2 standard:

> *Extend the use of function notation to express the image of a geometric figure in the plane resulting from a translation, rotation by multiples of 90 degrees about the origin, reflection across an axis, or dilation as a function of its pre-image (M2.F-IF.2).*

The purpose of this standard is likely to help students connect ideas about geometric transformations with ideas about functions. However, it is not clear if students are to write the transformation as a function (e.g., f(x,y) = (x,-y)) or do something else.

In addition to these weaknesses, the standards also lack a glossary, which is a standard feature of most states' standards.

## Recommendations

1. Create a single, unified K–12 standards document that includes an explanation of the overall structure of the standards, as well as the information about critical topics, progressions, and the like that is currently located in the Instructional Resources.
2. In that same document, include an explicit discussion of the meaning of the practice standards and how they should be connected to the content standards.
3. Address the noted issues with rigor and coherence—and in particular, the unnecessary limitations on arithmetic.
4. Clarify the wording of the high school standards, as well as any K–8 standards that were added after the 2010 revision.
5. Review the standards for the fourth-level math courses to ensure that they build from foundations in Math I–III and prepare students for college and career. (Standards removed since 2010 are reported as moved to "a fourth-level math." However, standards for this course are not provided, and the existing standards for fourth-level courses are from 2003.)
6. Include a glossary.

### Bottom Line

Significant revisions recommended. Standards should not be implemented until and unless these revisions are made.

## Documents Reviewed

- North Carolina Standard Course of Study for Mathematics, K–8 and Math I–Math III, accessed from http://maccss.ncdpi.wikispaces.net/North+Carolina+Standard+Course+of+Study+for+Mathematics.
- Cross-walks for K–8, accessed from http://www.ncpublicschools.org/curriculum/mathematics/scos/current.
- Revisions for High School standards, accessed from http://maccss.ncdpi.wikispaces.net/REVISED+High+School+Math+Standards+6-2016.

Mathematics

# Oklahoma

10 9 — **Strong**

*Recommend focus on the implementation of these standards.*

8 7 — **Good**

*Targeted revisions recommended along with a focus on implementation of these standards.*

6 5 — **Weak**

***Significant revisions recommended. Standards should not be implemented until and unless these revisions are made.***

4 3 2 1 — **Inadequate**

*Complete revision highly recommended. Standards have critical shortcomings and should not be implemented.*

## Overall Rating: Weak (5/10)

Content (3/7) + Communication (2/3)

## Overview

Oklahoma's math standards cover much of the key content of K–12 mathematics in clear, specific language. Arithmetic is a well-articulated focus in the early grades, as is proportional reasoning in the middle grades, and the standards include a useful theme of estimation throughout. Still, some crucial content areas are lacking in rigor or coherence, particularly in Arithmetic, Geometry, Statistics, and Probability. In general, the standards are inconsistent when it comes to promoting conceptual understanding. Finally, some individual standards are unclear, despite the helpful vertical alignment charts that show how concepts and skills progress through the grades.

## General Organization

Oklahoma's standards are organized by grade level from pre-K to grade 7, which is followed by Pre-Algebra, Algebra I, Geometry, and Algebra II (with the latter two having Algebra I as prerequisite).

There are four main content strands: Number and Operations; Algebraic Reasoning and Algebra; Geometry and Measurement; and Data and Probability. The high school standards also include Functions as a fifth strand. The standards are classified by strand, and each standard has more specific sub-standards called objectives.

The standards include vertical alignment charts for pre-K–grade 1, grades 2–4, grades 5–8 (Pre-Algebra), Algebra, and Geometry. At the pre-K–5 level, additional themes such as Numbers, Patterns, and Money are identified in these charts.

The standards include seven Mathematical Actions and Processes, which aim to promote "mathematical literacy" and have origins in the National Council of Teachers of Mathematics (NCTM) Process Standards. There are also four Guiding Principles: excellence for all students; the importance of deep understanding and curiosity in learning math; the essential roles of problem solving; and technology in teaching and learning math.

# Content

Oklahoma's standards generally promote focus, with an appropriate emphasis on key topics such as number and operations in the early grades, ratio and proportion in the middle grades, and logical and spatial reasoning and functions in high school. However, there are some problems with coherence and rigor, especially in Arithmetic, Geometry, and Statistics and Probability.

## + Content Strengths

Numbers and arithmetic are appropriately prioritized in the early grades, where there is a strong emphasis on place value and properties of operations, as demonstrated by the following third-grade standard:

> *Use strategies and algorithms based on knowledge of place value, equality and properties of addition and multiplication to multiply a two-digit number by a one-digit number (3.N.2.8).*

Notably, there also are specific standards on estimation as a tool to evaluate answers—a useful skill for students to hone as they become mathematically literate—such as the following fifth-grade standard:

> *Estimate sums and differences of fractions with like and unlike denominators, mixed numbers, and decimals to assess the reasonableness of the results (5.N.3.1).*

For the most part, other standards for these grades, such as those for data and measurement or geometry, support the focus on arithmetic by asking students to practice it in the context of solving problems.

For example, in standards like the one below, the geometric concept of area is developed rigorously and is meaningfully connected to multiplication:

> *Develop and use formulas to determine the area of rectangles. Justify why length and width are multiplied to find the area of a rectangle by breaking the rectangle into one unit by one unit squares and viewing these as grouped into rows and columns (3.GM.2.2).*

Proportional Reasoning, which is introduced in grade 7, is also coherently connected to many topics in the middle grades, including probability (relative frequencies), algebra (slope), and geometry (the definition of pi, similarity).

Finally, there is a clear emphasis on using algebra and functions in mathematical and real-world situations. For example, students are expected to know different representations of quadratic functions and to "use the representation that is most appropriate to solve real-world and mathematical problems" (A2.A.2.3). This flexibility is critical to developing students' capacity as problem-solvers.

## − Content Weaknesses

A crucial content weakness is the inconsistency of the expectations for conceptual understanding. For example, the first of the Mathematical Actions and Processes charges teachers with helping students "Develop a Deep and Flexible Conceptual Understanding," and there are multiple standards in which students are expected to "understand" a concept, process, or application. However, for about half of these standards, the related objectives focus exclusively on procedure, meaning the goal of conceptual understanding is unlikely to be met in practice.

In a similar vein, although procedural fluency is a stated goal, there are no explicit expectations for the instant recall of the addition and multiplication facts (e.g., 2 + 2 = 4), or use of the standard algorithm, as demonstrated by the capstone standard on whole number division:

> *Divide multi-digit numbers, by one- and two-digit divisors, using efficient and generalizable procedures, based on knowledge of place value, including standard algorithms (5.N.1.2).*

Because the wording of this standard does not appropriately prioritize *the* standard algorithm, some students may never learn the most efficient way to do division.

Another weakness of the elementary standards is the absence of several specific (and well-known) interpretations of addition, subtraction, and multiplication ("add to/take from," "put together/take apart," and "comparison"), despite the central role that these play in helping students know

when to use operations in context. Finally, there are several examples of needlessly slow pacing or awkward sequencing (e.g., delaying conversion between systems of measurement until grade 6).

Similar problems exist for higher grade levels. For example, in the Algebra strand, there is no explicit connection of sequences to functions, despite earlier work with "patterns" and "function machine[s]." And the glossary definition of the latter is misleading for future work with functions, suggesting (wrongly) that the input and output of a function cannot be the same:

> *Function machine: An input/output model (often made with milk cartons, boxes, or drawn on the board) to show one number entering and a different number exiting. Students guess the rule that produced the second number (e.g., enter 3, exit 5, rule: add 2).*

In the Geometry strand, there are serious issues with coherence and rigor. For example, the concept of volume is never introduced generally (though it does appear in the context of rectangular prisms in grade 5). Similarly, there is no standard or glossary entry for the definition of angle (either in terms of rays or as the amount of rotation around a point). And while congruence is defined in terms of transformations in the glossary, this definition does not align with the standard that introduces "congruency" in grade 6, nor is it connected to the triangle congruency criterion in high school.

In Statistics and Probability, there are also some notable gaps. For example, the concept of variability is mentioned only briefly, and random sampling and inference are addressed with similar brevity and out of sequence (in Pre-Algebra, after students have already been asked to make predictions based on summary statistics of data).

Finally, there are several gaps at the high school level. For example, trigonometric functions is underdeveloped, and there are no standards about categorical data or conditional probability. As a result, Oklahoma's math standards amount to weaker preparation for college and the workplace, especially given that high school students are only required to take three years of math.

# Communication

Oklahoma's standards are highly accessible thanks to their presentation in a single standards document, which includes features such as a glossary and vertical alignment charts. However, there are some vague or overly broad standards that require clarification.

## + Communication Strengths

Oklahoma's standards are mostly clear and user-friendly, as demonstrated by the following examples:

- *Represent multiplication facts by using a variety of approaches, such as repeated addition, equal-sized groups, arrays, area models, equal jumps on a number line and skip counting (3.N.2.1).*
- *Graph a rational function and identify the x- and y-intercepts, vertical and horizontal asymptotes, using various methods and tools that may include a graphing calculator or other appropriate technology (A2.F.1.6).*

The vertical alignment charts allow users to see related standards at a glance and to track ideas through the grade levels. However, they would benefit from more fine-grained alignment (i.e., alignment at the cluster and objective level, in addition to the strand level).

## − Communication Weaknesses

At every grade level, certain standards fail to establish clear and specific expectations for students. For example, the following standards are too vague to be of any real use to teachers:

- *Draw conclusions and make predictions from information in a graph (2.D.1.4).*
- *Apply probability concepts to real-world situations to make informed decisions (A1.D.2.4).*

In a similar vein, the language of other standards is too abstract, as demonstrated by the following sixth-grade standard, which is the first standard on probability:

> *Represent possible outcomes using a probability continuum from impossible to certain (6.D.2.1).*

This standard would be much clearer if it began with the concept of a "chance event" and then introduced the concept of probability as a number between 0 (impossible) and 1 (certain).

Other standards are also difficult to parse, especially in high school geometry, where many standards suggest "using algebraic reasoning and proofs" without explaining what this means in practice. For example, it is not clear from the following standard whether students are to prove that vertical angles are congruent, use this result, or both:

- *Apply the properties of angles, including corresponding, exterior, interior, vertical, complementary, and supplementary angles to solve real world and mathematical problems using algebraic reasoning and proofs (G.2D.1.2).*

Finally, the standards need to clarify the expectations regarding the use of graphing calculators in Algebra, as the current language could be read to suggest that students can use them for tasks they should be able to do by hand.

## Recommendations

1. Revisit all standards that call for conceptual understanding and reasoning, and align the objectives of these standards to support this goal.
2. Revise the K–6 standards on addition, subtraction, multiplication, and division so they explicitly reference the standard algorithms for each of these operations.
3. In middle and high school geometry, address the inconsistencies and clarity issues noted above.
4. Revisit standards related to probability and statistics to address issues related to specificity and coherence, and create a vertical alignment chart specific to this content.
5. At the high school level, consider including standards on trigonometric functions to fully prepare students for further STEM courses and/or requiring a fourth-year math course to further prepare students for college and career.

### Bottom Line

Significant revisions recommended. Standards should not be implemented until and unless these revisions are made.

## Documents Reviewed

- Oklahoma Academic Standards – Mathematics (2016), accessed from http://sde.ok.gov/sde/standards-and-assessments-oklahoma-mathematics.
- Crosswalks for the Oklahoma Academic Standards – Mathematics, accessed from http://sde.ok.gov/sde/standards-and-assessments-oklahoma-mathematics.

Mathematics

# Pennsylvania

10 9 **Strong**

*Recommend focus on the implementation of these standards.*

8 7 **Good**

*Targeted revisions recommended along with a focus on implementation of these standards.*

6 5 **Weak**

*Significant revisions recommended. Standards should not be implemented until and unless these revisions are made.*

4 3 2 1 **Inadequate**

***Complete revision highly recommended. Standards have critical shortcomings and should not be implemented.***

## Overall Rating: Inadequate (4/10)

Content (3/7) + Communication (1/3)

## Overview

The Pennsylvania Academic Standards for Mathematics (PASM) do not provide a strong basis for a rigorous program in K–12 mathematics. At just seventeen pages, the main standards document for the PASM is too brief to convey an adequately detailed sense of the knowledge and skills that are required, and many of the standards it includes are vague or confusing. At each grade level (3–8), the PASM are supplemented by separate documents that list *Assessment Anchors and Eligible Content*. (Eligible content items for high school may be accessed through a different web page.) Each grade-level's anchors document is roughly the length of the entire PASM. However, the focus is on assessment, and the eligible content items (like the standards themselves) are sometimes vague or confusing. Consequently, the overall framework is difficult to work with and does not effectively establish or support robust educational goals. In short, the PASM are deeply flawed.

## General Organization

The PASM cover pre-K through high school, and include both content and practice standards (in separate documents). The Standards for Mathematical Content are organized into four broad content areas: Number and Operations; Algebraic Concepts; Geometry; and Measurement, Data, and Probability. These content areas are then subdivided. For example, Number and Operations is partitioned into Counting and Cardinality (pre-K and K only), Number and Operations in Base 10 (grades K–5), Number and Operations—Fractions (grades 3–6), Ratios and Proportional Relationships (grades 6–7), The Number System (grades 6–8) and Number and Quantity (high school). An organizational diagram of the content area

and subdivisions is provided. Pennsylvania's Standards for Mathematical Practice consist of the same eight standards that are found in the Common Core State Standards for Mathematics (CCSS-M). However, in the PASM, they are presented without any detailed explanation.

The core PASM document is remarkably brief. For example, there are only six pages for grades pre-K–5, and another six pages for grades 6–8 and high school (combined). Standards for each subtopic are listed in a horizontal band that is divided into columns for each grade level, so that one can attempt to trace the progress of mathematical themes across grades. However, the vagueness of the standards makes actually doing so challenging.

In most cases, the standards presented in PASM are broad learning goals, such as one might find in a grade level overview in most states' standards. In grades pre-K–2, there is no finer-grained description than that given in the PASM. However, in each of grades 3–8, the PASM are supplemented with grade-specific documents: the *Mathematics Assessment Anchors* and *Eligible Content Aligned to the Pennsylvania Core Standards*. These supplementary documents are similar to the individual standards one finds in other states. However, they are oriented toward assessment and organized in a complicated way.[1] And the eligible content material for high school is difficult to find because it is located on a separate web page.

In addition to the core standards and the anchors, there is an extensive glossary, which, at sixty-two pages, is more than three times longer than the standards themselves.

# Content

The brevity of the core standards and the inconsistent organization of the supplementary documents results in a lack of coherence, which makes it difficult to extract clear and specific learning goals.

## + Content Strengths

The content standards begin with expectations for pre-K, and pay significant attention to numbers and arithmetic in the early grades. For example, third graders must "demonstrate multiplication and division fluency" (CC.2.2.3.A.3) (though there is no Assessment Anchor or Eligible Content attached to this standard). Fractions are also heavily emphasized in grades 4 and 5, with some preparatory work in earlier grades. Similarly, the middle school standards emphasize proportional reasoning, as well as linearity and linear equations. And the high school standards mention major themes such as functions, graphing, modeling, trig functions, the Pythagorean Theorem, and "verifying" theorems in geometry.

For the most part, the standards are accurate. And some of them are lifted from the CCSS-M, meaning that teachers who consult those standards could make reasonable guesses about some of the missing details.

## − Content Weaknesses

Perhaps the most telling indication of content weakness is the statement in the introduction to the PASM that the task of preparing students to "think and reason mathematically" is the domain of middle and high school. This implicitly suggests that elementary school mathematics does not involve these important skills—a troublingly low expectation.

In addition to this disappointing outlook, the vagueness and odd organization of the standards lead to multiple shortcomings that are both content and communication weaknesses. For example, two of the main topics of elementary school—whole number arithmetic and fractions—have significant problems.

First, although "place-value concepts" are invoked in six of the Core Standards, the meaning of this phrase is not carefully explained, and the concepts themselves are not well developed anywhere in the standards. (Similarly, the entry on "place value" in the sixty-two-page *Mathematics Glossary* is very brief and uninformative about the principles behind place value notation.) Without an understanding of these key ideas, students will not achieve robust numeracy, so teachers need further guidance as to how and where to develop these concepts.

Remarkably, Pennsylvania never reaches closure on either the addition facts or the multiplication facts. For example, the grade 2 standard, "Use mental strategies to add and subtract within 20" (CC.2.2.2.A.2), does not specifically require students to know from memory all sums of two one-digit numbers or to *fluently* add and subtract within 20. Oddly, both this standard and the first-grade standard, "Represent and solve problems involving addition and subtraction within 20" (CC.2.2.1.A.1), appear in the Operations and Algebraic Thinking section, rather than under Number and Operations in Base 10.

In general, the role of addition and subtraction within 20 for learning the higher addition and subtraction facts, and their relation to structure, is underemphasized in Pennsylvania's standards. Multiplication presents a similar problem, as one finds no call to know from memory all products of one-digit numbers and no standard requiring students to *fluently* multiply and divide within 100. Without such fluency, students will be hindered in applying arithmetic to solve problems.

The Number and Operations in Base 10 standards do not include any mention of algorithms, let alone the standard algorithms. Indeed, the only mention of the standard algorithms in the PA Standards is in the Key Terms on page 17, where a Standard Algorithm is defined as "a locally agreed upon method of computation which is conventionally taught for solving mathematical problems." This dismissive definition is misleading and a disservice to both teachers and students.

The apex of the computational expectations seems to be the following standard:

> *Use place-value understanding and properties of operations to perform multi-digit arithmetic (CC.2.1.4.B.2).*

This is simply not specific or detailed enough to be a helpful standard.

Even Pennsylvania's treatment of bedrock concepts of addition and subtraction is weak. For example, it starts off ambitiously with the following pre-K standard:

> *Understand addition as putting together and adding to, and understand subtraction as taking apart and taking from (CC.2.2.preK.A.1).*

However, the follow up in grades K–1 is inadequate. In particular, the third basic category of addition/subtraction problems (involving additive comparison) is not recognized in the PA standards. And addition and subtraction within 100, a first-grade topic in many states, is not listed until grade 2 (CC.2.2.2.A.1).

In summary, Pennsylvania's whole number standards display many weaknesses, and there is not enough focus on arithmetic in the early grades. In its place, perhaps, is substantial attention to data in grades 2–3. However, despite the increasing importance of data in society, developing strong number skills should be the priority for this age group.

There are also significant problems with the development of fractions. For example, consider the following grade 3 and grade 4 standards:

- *Explore and develop an understanding of fractions as numbers (CC.2.1.3.C.1).*
- *Build fractions from unit fractions by applying and extending previous understandings of operations on whole numbers (CC.2.1.4.C.2).*

Based on the wording of these standards, one might suspect that Pennsylvania starts fraction development without introducing unit fractions. However, in the grade 3 Assessment Anchors, one finds the following Eligible Content standard:

> *Demonstrate that when a whole or set is partitioned into y equal parts, the fraction 1/y represents 1 part of the whole and/or the fraction x/y represents x equal parts of the whole (limit denominators to 2, 3, 4, 6, and 8; limit numerators to whole numbers less than the denominator; and no simplification necessary) (M03.A-F.1.1.1).*

In other words, Pennsylvania *does* want teachers to start with unit fractions. Yet by limiting teachers and students to numerators "less than the denominator," it fails to realize the advantages of this approach, such as considering fractions with numerators as large as desired (thus providing students with an overview of the full system of fractions with a fixed denominator). In short, Pennsylvania's treatment of fractions is not as coherent and comprehensive as it should be, and is not transparent from the PASM alone.

Further weaknesses appear in middle and high school. For example, in the middle school geometry standards, neither perpendicular lines nor the number pi are mentioned (though the latter must be used to give the area of a circle). And even more amazingly, the word "proof" is never used in the standards for high school geometry (though they do appear in the Geometry Assessment Anchors). The high school geometry standards also include a number of cryptic and/or hard-to-interpret standards such as:

> *Apply geometric theorems to verify properties of circles (CC.2.3.HS.A.8).*

No doubt, some teachers would be surprised to learn that the Eligible Content for this standard includes G.1.1.1.4, "Identify and/or use the properties of a sphere or cylinder."

# Communication

The PASM are organized efficiently yet they are terse to a fault.

## + Communication Strengths

The PASM are brief and few in number, so it is easy to read through them quickly. They are also arranged by grade level in columns, and by subject area across horizontal bands, so one may quickly get an overview of the content of each grade level, or how a given topic progresses across the grades. Finally, the diagram on page 4 also provides a good overall picture of the progression of themes through K–12.

## − Communication Weaknesses

The primary weakness of the Pennsylvania standards is the endemic lack of clarity that stems from the consistent lack of supporting detail. The content standards are terse to a fault, and as a result, the logical development of the mathematical topics is either not spelled out or spelled out incompletely. As illustrated by many of the examples in this review, the scope of the content standards is not always specified. (For example, CC.2.1.PreK.A.3 suggests that students "compare numbers" but does not indicate which numbers are to be compared.)

Furthermore, there are no overviews for individual grade levels or courses, nor is there any other indication of their main foci or learning goals. At the high school level there is no effort to assemble these standards into courses, and no discussion of ideas or goals for this age group. Finally, the Practice Standards are listed as phrases (e.g., "attend to precision") but are never explained, illustrated, or connected to the content standards in a meaningful way.

# Recommendation

The Pennsylvania Standards are so weak that a list of specific recommendations would be pointless. The sooner Pennsylvania goes back to the drawing board, the better.

## = Bottom Line

Complete revision highly recommended. Standards have critical shortcomings and should not be implemented.

## Documents Reviewed

- Academic Standards for Mathematics, Pennsylvania Department of Education, accessed from http://www.education.pa.gov/Teachers%20%20Administrators/Curriculum/Pages/Mathematics.aspx#tab-1.
- Assessment Anchors and Eligible Content (available for grades 3–8 only), accessed from http://www.education.pa.gov/k-12/assessment%20and%20accountability/pssa/pages/assessment-anchors.aspx#tab-1.
- Glossary to the Assessment Anchors and Eligible Content, accessed from https://static.pdesas.org/content/documents/Mathematics%20Glossary.pdf.

## Endnotes

1. For example, the fourth-grade standard CC.2.4.4.A.6, "Measure angles and use properties of adjacent angles to solve problems," is assigned an Assessment Anchor ("Geometric measurement: understand concepts of angle; measure and create angles"(M04.D–M.3)); a Descriptor ("Use appropriate tools and units to sketch an angle and determine angle measurements" (M04.D–M.3.1)); and two Eligible Content tasks ("Measure angles in whole-number degrees using a protractor. With the aid of a protractor, sketch angles of specified measure" (M04.D–M.3.1.1) and "Solve addition and subtraction problems to find unknown angles on a diagram in real-world and mathematical problems. Angles must be adjacent and non-overlapping" (M04.D–M.3.1.2)).

Mathematics

# Tennessee

10 9 8 7 6 5 4 3 2 1

**Strong**

*Recommend focus on the implementation of these standards.*

**Good**

***Targeted revisions recommended along with a focus on implementation of these standards.***

**Weak**

*Significant revisions recommended. Standards should not be implemented until and unless these revisions are made.*

**Inadequate**

*Complete revision highly recommended. Standards have critical shortcomings and should not be implemented.*

## Overall Rating: Good (7/10)

Content (5/7) + Communication (2/3)

## Overview:

The Tennessee Math Standards (TMS) are admirably focused and appropriately rigorous and coherent in most (but not all) areas of content. The focal content for each grade (K–8) is clearly highlighted, and many illustrative examples are included, making the standards a useful document for teachers and other stakeholders. However, there are some issues with rigor and coherence in whole number arithmetic, geometry, and statistics. And for various reasons, some individual standards are unclear. For example, some standards combine multiple ideas in a way that obscures key points, while others refer to definitions that are never provided (because there is no glossary).

## General Organization

The Tennessee Math Standards are organized by grade at the elementary and middle school levels and by course in high school, like most states' standards. Individual content standards are organized into clusters that are themselves grouped under various domains. And these domains evolve appropriately with grade level. (For example, Number and Operation in Base 10 spans K–5, while The Number System and Ratios and Proportional Relationships are domains in grades 6–8.) At the high school level, standards are organized into two main pathways: Algebra I, Geometry, Algebra II; and Integrated Mathematics I, II, and III. All students must complete one of these pathways, followed by a fourth-year mathematics course.

For each grade level (K–8), there is an introduction with an "overview of the mathematical concepts and skills." (Standards that are a major focus of the grade are highlighted in green.) Similarly, each high school course has a brief

introductory paragraph followed by a list of major and supporting clusters that are grouped into conceptual categories such as "Seeing Structure in Expressions." (There is also a *Scope and Clarifications* sidebar that provides illustrative examples or distinguishes the levels for different courses.)

Standards for Mathematical Practices that are identical to those in the Common Core State Standards are also included, along with four "Literacy Skills for Mathematical Proficiency":

1. *Use multiple reading strategies.*
2. *Understand and use correct mathematical vocabulary.*
3. *Discuss and articulate mathematical ideas.*
4. *Write mathematical arguments.*

These skills focus on the communication of mathematics (e.g., how to read different representations of the same information in a math problem) and are a useful complement to the Standards for Mathematical Practices.

# Content

Tennessee's standards address key content in a focused way and are generally rigorous and coherent. However, there are some issues with a few key topics in geometry, statistics, and whole-number arithmetic.

## + Content Strengths

Tennessee's standards achieve a laudable degree of focus by making a distinction between the "major work" and "supporting work" of each grade. For example, in the early grades, arithmetic, number sense, and related measurement ideas (such as area) are rightly highlighted as major work, while geometry and data work are considered supporting content.

The arithmetic content is coherently developed. For example, work with fractions in grade 3 begins with understanding a fraction *a/b* as *a* parts of size *1/b*. And there are notably clear expectations for procedural fluency with so-called "math facts," as demonstrated by the following third-grade standard:

> *By the end of third grade, know from memory all products of two one-digit numbers and related division facts (3.OA.C.7).*

The standards also emphasize the application of concepts throughout the grade levels, as demonstrated by the following grade 1 and Algebra II standards:

- *Add and subtract within 20 to solve contextual problems, with unknowns in all positions, involving situations of add to, take from, put together/take apart, and compare (1.OA.A.1).*
- *Interpret the parameters in a linear or exponential function in terms of a context. For example, the equation y = 5000 (1.06)x models the rising population of a city with 5000 residents when the annual growth rate is 6 percent. What will be the effect on the equation if the city's growth rate was 7 percent instead of 6 percent (A2.F.LE.B.3)?*

At the high school level, algebra and most of geometry are rigorously developed, with a balanced emphasis on skills, concepts, and applications. In most cases, the *Scope and Clarifications* section helps to illuminate the progression of standards across courses. For example, the Algebra I standard about factoring quadratic polynomials (A1.A.REI.B.3) notes that students will formally learn the connection between factoring and zeros of polynomials in Algebra II.

## − Content Weaknesses

At the elementary level, there are some crucial weaknesses in whole number operations. For example, students are inexplicably limited to conversions *within* metric and customary systems (e.g., meters to centimeters, or feet to inches), but are not expected to convert *between* systems (e.g., inches to centimeters) as is often required in real-world situations.

Furthermore, there is no mention of the standard algorithm for any operation, as demonstrated by the fifth-grade capstone standard on multiplication:

> *Fluently multiply multi-digit whole numbers (up to three-digit by four-digit factors) using appropriate strategies and algorithms (5.NBT.B.5).*

Note that the standard mentions only "algorithms," thus potentially disadvantaging students who do not learn the efficient standard algorithm.

On a related note, the standards refer to place value but not always coherently, as demonstrated by the following second-grade standard:

> *Know that the three digits of a three-digit number represent amounts of hundreds, tens, and ones (e.g., 706 can be represented in multiple ways as 7 hundreds, 0 tens, and 6 ones; 706 ones; or 70 tens and 6 ones) (2.NBT.A.1).*

This standard conflates three related but fundamentally distinct ideas: the meaning of the digits in base 10, the foundational fact that a hundred is ten 10s, and the concept of decomposing a number in different ways. Consequently, some teachers may fail to make these distinctions in practice.

Explaining the reasoning behind arithmetic computations can help build students' conceptual understanding, and is an important opportunity to use the Standards for Mathematical Practices and Literary Skills for Mathematical Proficiency—as demonstrated by the following second-grade standard:

> *Add and subtract within 1000 using concrete models, drawings, strategies based on place value, properties of operations, and/or the relationship between addition and subtraction to explain the reasoning used (2.NBT.B.7).*

Unfortunately, there are no such expectations for multiplication in grade 3, and in grades 4–5 the standards do not explicitly ask students to explain their reasoning.

When it comes to middle and high school geometry, there is a lack of coherence with regard to congruence, similarity, and transformations. Specifically, experimenting with transformations is addressed in grade 8, but this work is never explicitly connected to the high school standards on congruence.[1] (Furthermore, *congruence* is never defined, as there is no glossary.)

Other high school topics—such as the geometry of circles, general trigonometry, and statistics—are also underdeveloped. For example, there is a cluster titled "B. Summarize, represent, and interpret data on two categorical and quantitative variables." Yet no required standards at the middle or high school levels address categorical data. (Standards for fourth-year courses do address some of these topics, but these are not required for all students.)

# Communication

The standards are mostly clear, and the many illustrative examples and clarifications are generally helpful. However, some standards are confusing because they unwisely attempt to combine multiple ideas, or because they refer to definitions that are never provided (again, because there is no glossary). At the high school level, the standards' organization into course sequences is useful for implementation, but also leads to some inconsistencies.

## + Communication Strengths

The standards include many appropriate examples, which are either embedded in the standard itself or included in the *Scope and Clarifications* section.

The grade-level introductory paragraphs describing the content provide a useful overview of the main goals for the grade and how ideas progress. For example, in grade 4, we learn that "This is the first time students find and interpret remainders in context."

The organization of high school topics into traditional and integrated course sequences is useful, and the Scope and Clarifications section clearly distinguishes the grade level of standards if they are repeated. For example, in the case of the repeated standards A1.A.SSE.A.2 and A2.A.SSE.A.2—"Use the structure of an expression to identify ways to rewrite it"—this section notes that in Algebra I, the focus is numerical and one-variable expressions versus more general algebraic expressions in Algebra II.

## − Communication Weaknesses

While useful overall, the *Scope and Clarifications* sections are sometimes confusing. For example, the high school geometry standards state that students must be able to "prove" key results. However, they also include the following clarification:

> *Proving includes, but is not limited to, completing partial proofs; constructing two-column or paragraph proofs; using transformations to prove theorems; analyzing proofs; and critiquing completed proofs.*

While useful for teachers seeking to scaffold student work with proofs, this explanation could result in decreased rigor if students only complete partial proofs as opposed to proving things from scratch.

In addition to these inconsistencies, as noted in the section on "content weaknesses," there are also several standards that are needlessly confusing because they attempt to combine two or more ideas (and in so doing, obscure or conflate the key points).

Also, the two high school sequences articulated in the standards have inconsistent coding and occasionally conflicting expectations, making it difficult to compare them or use material across sequences. And the introduction to the Integrated Math (IM) sequence does not make the progression of ideas clear.[2]

Finally, the absence of a glossary is a serious oversight and a missed opportunity to promote the second literacy standard: *Understand and use correct mathematical vocabulary.*

# Recommendations

1. At the elementary level, revise the capstone arithmetic standards to include fluency with *the* standard algorithm. Also, consider introducing standards that make explicit the key role of place value and decomposing numbers in computation of operations.
2. In middle and high school geometry, address the coherence issues related to transformations and congruence, and clarify the expectations for proof.
3. Revisit the standards on statistics, with an eye toward clarity and rigor.
4. Include a Glossary and Table of Contents.
5. Align the standards and coding in the two high-school pathways to ensure that students have the same expectations in both sequences.
6. Though not a focus of this review, the fourth-year Bridge Math course should be revised to distinguish it from the previous standards (many of which are repeated) and include more material that will help prepare students for college and the workplace (such as trigonometry and statistics).

## Bottom Line

Targeted revisions recommended along with a focus on implementation of these standards.

## Documents Reviewed

- Tennessee Math Standards (TMS), accessed from http://www.tn.gov/education/article/mathematics-standards.
- Side-by-Side Analysis of the Tennessee Math Standards 2015 Draft, accessed from https://www.achieve.org/publications/review-tennessee%E2%80%99s-draft-mathematics-academic-standards.[3]

## Endnotes

1. See standard G.CO.B.6.
2. For example, the IM II statement "This course also focuses on geometric similarity and interpreting functions from a real life context," mentions two mostly unrelated topics and does not connect the concept of similarity to congruence, a topic in IM I.
3. These were consulted as a substitute for a crosswalk, which is not available from the state site.

Mathematics

# Texas

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**Strong**

*Recommend focus on the implementation of these standards.*

**Good**

*Targeted revisions recommended along with a focus on implementation of these standards.*

**Weak**

*Significant revisions recommended. Standards should not be implemented until and unless these revisions are made.*

**Inadequate**

*Complete revision highly recommended. Standards have critical shortcomings and should not be implemented.*

## Overall Rating: Strong (9/10)

Content (7/7) + Communication (2/3)

## Overview

Overall, the Texas Essential Knowledge and Skills (TEKS) for Mathematics are focused, coherent, and rigorous. In grades K–5, key arithmetic concepts and skills are well developed. Similarly, the standards for grades 6–8 are logical and coherent. And the high school sequence (Algebra I, Geometry, Algebra II, and Precalculus) is strong and well articulated, with comprehensive content coverage. The TEKS focus on student outcomes, with less detail and fewer explanations than some other standards. However, because they do a very good job of specifying those outcomes and get the math right in each grade and course, they form a strong foundation for a high-quality mathematics curriculum.

## General Organization

Chapter 111 of the Texas Administrative Code (TAC) describes the mathematical content and skills expected of students in three documents: Elementary, Middle, and High School (Subchapters A, B, and C, respectively). In addition to Chapter 111, vertical alignment charts spanning K–Algebra II, as well as many other resources, may be found online.[1]

The K–8 standards are organized by grade level. Each grade begins with an introduction that describes the mathematical process standards and the focus of the grade, followed by a detailed set of content standards that are grouped by domain (e.g., Number and Operations, Algebraic Reasoning, and Proportionality). Notably, the introductions specify what technology is appropriate for each grade. The K–8 content standards also include a domain on personal financial literacy in each grade.

At the high school level, the standards are organized by course, with a conventional sequence of Algebra I, Geometry, Algebra II, and Precalculus, as well as courses in Mathematical Models with Applications; Advanced Quantitative Reasoning; Independent Study in Mathematics; Discrete Mathematics for Problem Solving; Statistics; and Algebraic Reasoning. (Students may satisfy the state's high school graduation requirements by taking Algebra I and Geometry and a third year of mathematics chosen from other courses.) To be certain that all students have a core competency in probability, this material is included in the Geometry course. Finally, there are very brief formal standards for AP and IB courses (Chapter 111, Subchapter D). However, rather than providing independent information about the content of these courses, they refer to relevant documents published by the College Board and the International Baccalaureate of North America.

# Content

The TEKS are rich in content, rigorous, and suitably paced. Despite a few minor faults in specific grades and topics, overall they support college- and career-readiness for all students, and STEM readiness for students who complete the high school courses through Precalculus.

## + Content Strengths

The TEKS standards are very solid at the elementary (K–5) level, where the focus is rightly on number and operations. They emphasize place value and the development of the four operations—first for positive whole numbers and then fractions. The learning progression around decimals is strong, and is appropriately based on both a systematic development of fractions and base-10 concepts. Topics such as geometry and measurement, the representation of data, algebraic reasoning, and financial literacy are included, but should not distract from the focus on number and operations.

The elementary standards establish particularly clear expectations in three critical ways: First, students are expected to learn their number facts "with automaticity" (e.g., 2.4.A). Second, they are expected to be able "to use the standard algorithms" for the addition, subtraction, multiplication, and division of whole numbers and decimals (e.g., 4.4.A). Finally, the grade-level introductions state that they are expected "to perform their work without the use of calculators."

At the middle school (6–8) level, the focus of the TEKS shifts to proportionality and proportional relationships—a critical topic that paves the way for much of the math to follow. Additional themes of the middle school standards include linearity and slope, solving two simultaneous linear equations, the foundations of functions, data and probability, aspects of financial literacy, the Pythagorean Theorem and its consequences, and aspects of planar transformations. In general, the breadth and depth of this material is suitable for middle school.

Finally, at the high school level, the conventional high school math sequence of Algebra I, Geometry, Algebra II, and Precalculus does a thorough job of covering the content that students need to be prepared for Calculus. The TEKS also include some important topics that are missing from most state standards, such as solving "systems of three linear equations in three variables by using Gaussian elimination" and the formal statement and use of the Triangle Inequality (2A.3.B).

## – Content Weaknesses

Though strong overall, the TEKS could do a better job of spelling out several important learning goals. For example, students in grade 2 are asked to "solve one-step and multi-step word problems involving addition and subtraction within 1,000 using a variety of strategies based on place value, including algorithms" (2.4.C). However, the standards do not specify (in this context) that some strategies might be better than others for a particular problem, and that choosing a strategy for a particular problem is an important expectation. Similarly, students in Algebra I are expected to "simplify numeric and algebraic expressions using the laws of exponents, including integral and rational exponents" (A.11.B). But the standards do not mention the connection between the laws of exponents and the definition of raising to a rational exponent. (For example, 3 raised to the ½ is defined as the square root of 3.) Students should understand this connection.

At all grade levels, the personal financial literacy standards could be a source of relevant mathematical applications. However, because they are not well integrated with math content, in practice they could be a distraction. For example, it would be easy to connect standards about loans and savings to algebraic expressions and exponents, but this has not been done. And some standards are developmentally inappropriate. For example, students in second grade are expected to "identify examples of lending and use concepts of benefits and costs to evaluate lending decisions" (2.11.E).

In addition to these oversights, there are some questionable organizational choices. For example, despite the importance of systematically developing geometric skills and understandings, the TEKS do not have a formal geometry domain in grades 6–8. Instead, geometry topics are included within Expressions, Equations, and Relationships. Similarly, most of the standards related to probability are housed under Proportionality in grade 7.

# Communication

The Texas standards are well written, with clear performance benchmarks, as well as helpful introductions that concisely and precisely describe the main foci of each grade or course. However, they often neglect to explain how material and concepts are developed, leaving teachers to fill this in for themselves.

## + Communication Strengths

In general, the TEKS do a good job of balancing precision and concision. The overview for each grade or course clearly indicates its foci and goals, and the subsequent list of topics is well organized and complete. The process standards are described clearly, as is the need to connect them to content. And the technology that is suitable for a given grade or topic is clearly indicated. Finally, the Texas standards website includes a significant amount of supplementary material that is easy to access.

## − Communication Weaknesses

The development of mathematical topics in the TEKS is often implicit rather than explicit, leaving teachers and curriculum developers with an unusual amount of work to do for themselves. For example, even in first grade, there is no standard specifically indicating that students should understand that the two digits in a two-digit number represent amounts of tens and ones. And there are no examples anywhere in the standards. For instance, standard 5.3.L expects fifth-grade students to "divide whole numbers by unit fractions and unit fractions by whole numbers." But it does not elaborate on this expectation. In contrast, the comparable Common Core standard (5.NF.7) provides a detailed treatment that includes three separate sub-standards, two sample story problems, and multiple examples.

In a few places, the intent of the TEKS is unclear due to a lack of specificity or precision. For example, standard 2.10.D asks second graders to "draw conclusions and make predictions from information in a graph," and standard 7.6.H asks seventh graders to "solve problems using qualitative and quantitative predictions and comparisons from simple experiments." Furthermore, there are a few identical (or very similar) standards that appear in multiple grades or courses.[2] And in many cases, it is unclear if the apparent repetition is intended as a review or if there are different expectations for different grade levels.

In addition to these weaknesses, the TEKS contain a certain amount of boilerplate and repetition, from legal language about implementation authority to wordy process standards that are repeated for each grade—making them less compelling and user-friendly than they could be.

Finally, although the TEKS provide many course options at the high school level, it is hard to tell which math content is expected of all students for college- and career-readiness.

# Recommendations

To better communicate the expectations embodied in its math standards, Texas should take the following steps:

1. Include both examples and more information about the development of mathematical topics in the text of the standards or provide clearer links between the standards and the relevant supporting documents on the TEA website.
2. Integrate the personal financial literacy standards more closely with the traditional math content for each grade level.
3. Add a Geometry domain in middle school.
4. Specify the high school math content that all students are expected to learn for college- and career-readiness.
5. Provide a version of the standards that omits the legal language and bureaucratic jargon found in Chapter 111.
6. Extend the Vertical Alignment Charts in the supporting documents and develop a "coherence map."[3]
7. Consider providing standards for more advanced courses such as Probability & Statistics and Calculus (as California does).

## Bottom Line

Recommend focus on the implementation of these standards.

## Documents Reviewed

- Chapter 111. Texas Essential Knowledge and Skills (TEKS) for Mathematics, accessed from http://ritter.tea.state.tx.us/rules/tac/chapter111/index.html.
- Supporting documents, accessed from http://tea.texas.gov/Academics/Subject_Areas/Mathematics/Resources_for_the_Revised_Mathematics_TEKS/.

## Endnotes

1. See https://www.texasgateway.org/resource/mathematics-teks-supporting-information.
2. For example: 7.13.E and 8.12.D; 7.7 and 8.5.B; A.2.F and G.2.C.
3. Though not part of the formal standards, these supplementary documents show connections between different mathematical topics and across grades (see, e.g., https://achievethecore.org/coherence-map/), and promote coherence.

Mathematics

# Virginia

10 9 8 7 6 5 4 3 2 1

**Strong**

*Recommend focus on the implementation of these standards.*

**Good**

***Targeted revisions recommended along with a focus on implementation of these standards.***

**Weak**

*Significant revisions recommended. Standards should not be implemented until and unless these revisions are made.*

**Inadequate**

*Complete revision highly recommended. Standards have critical shortcomings and should not be implemented.*

## Overall Rating: Good (7/10)

Content (4/7) + Communication (3/3)

## Overview

The Virginia Standards of Learning (SOL) and the accompanying Curriculum Framework (CF) comprise a teacher-friendly set of mathematical content standards and process goals. However, the CF also includes a number of redundancies and an eclectic collection of instruction-related elements that may negatively impact the inherent focus, coherent progression, and rigor of the associated standards.

## General Organization

The structure of Virginia's math standards is unique. The essential components of academic content are captured in the 2016 Standards of Learning, which simply lists the standards for kindergarten through eighth grade and for a core set of high school courses. However, in addition to the core SOL, there is also a Curriculum Framework, a much longer companion document that "amplifies" the SOL.

The CF is organized into two columns, "Understanding the Standard" and "Essential Knowledge and Skills," which are explained as follows:

- *Understanding the Standard includes mathematical content and key concepts that assist teachers in planning standards-focused instruction. The statements may provide definitions, explanations, examples, and information regarding connections within and between grade level(s)/ course(s).*
- *Essential Knowledge and Skills provides a detailed expansion of the mathematics knowledge and skills that each student should know and be able to demonstrate.*

Because of the intentional interconnectedness of the SOL and CF, both documents are reviewed, with special attention to the CF since it subsumes the SOL document.

The K–8 content is organized into five content strands: Number and Number Sense; Computation and Estimation; Measurement; Geometry; Probability and Statistics; and Patterns, Functions, and Algebra. The high school standards are organized into nine courses: Algebra I; Geometry; Algebra, Functions, and Data Analysis; Algebra II; Trigonometry; Computer Mathematics; Probability and Statistics; Discrete Mathematics; and Mathematical Analysis.

# Content

The SOL are thoughtfully organized and sequenced. And at forty-eight pages, they are also concise. However, the entire CF is more than 450 pages long, which may account for its uneven quality.

## + Content Strengths

The development of fractions is aggressive and starts at the kindergarten level, with the concept of "equal sharing." Halves and fourths are introduced in first grade, and eighths, tenths, thirds, and sixths are introduced in second grade. First- and second-grade students are expected to name, write, represent, and compare (grade 2 only) unit fractions. Finally, comparing fractions with like and unlike denominators using words and symbols (e.g., >, <) with models is introduced in third grade.

Fluency of single-digit addition/multiplication facts is clearly defined in grades K–4. And estimation is strongly promoted in grades K–6. Other notable content strengths include the following:

- The Front Matter and Strand Introductions in the CF spell out grade-band foci and progressions for grades K–2, 3–5, and 6–8, and they are excellent.
- The Pattern, Function, and Algebra strand is well developed for grades K–8 and connects nicely with the high school algebra courses.
- The high school standards are organized into a logical sequence for the nine courses presented—some of which are beyond the typical algebra-geometry scope. For example, Mathematical Analysis provides a solid foundation for future calculus courses.
- The five Process Goals, which are based on the National Council of Teachers of Mathematics (NCTM) (2000) Process Standards, are well thought out. These goals include: becoming mathematical problem solvers, communicating mathematically, reasoning mathematically, making mathematical connections, and using mathematical representations to model and interpret practical situations.
- Finally, some standards in grades 4–7 are labeled with an asterisk, indicating that they will be assessed without the use of a calculator on the state assessment. This instructional "alert" is a desirable feature of the SOL.

## – Content Weaknesses

The Virginia standards have three overarching weaknesses. First, there are numerous redundancies and inconsistencies in the CF, which disrupt the coherent progression of mathematical concepts and blur the focus of the standards. For example, the following statements in the Trigonometry CF are clearly redundant:

- *Both degrees and radians are units for measuring angles (Trigonometry CF, T.1).*
- *Degrees and radians are units of angle measure (Trigonometry CF, T.2).*

Similarly, there is a great deal of overlap between the following CF statements for two Geometry standards:

- *Inductive reasoning, deductive reasoning, and proof are critical in establishing general claims. Deductive reasoning is the method that uses logic to draw conclusions based on definitions, postulates, and theorems (Geometry CF, G.1).*
- *Deductive or inductive reasoning is used in mathematical proofs. In this course, deductive reasoning and logic are used in direct proofs. Direct proofs are presented in different formats (typically two-column or paragraph) and employ definitions, postulates, theorems, and algebraic justifications including coordinate methods (Geometry CF, G.2).*

As a result of such redundancies, instructional inconsistencies occur routinely within the *Understanding the Standard* statements in the CF. For example, consider the following grade 6 guidance for standard 6.2.b, comparing and ordering positive rational numbers:

- *Strategies using 0, 1/2, and 1 as benchmarks can be used to compare fractions (Grade 6 CF, 6.2).*
- *When comparing two fractions close to 1, use the distance from 1 as your benchmark (Grade 6 CF, 6.2).*

There is also repetition across grade levels, as demonstrated by the CF guidance for the following sixth- and seventh-grade standards:

- *An integer and its opposite are the same distance from zero on a number line. Example: the opposite of 3 is –3 and the opposite of –10 is 10 (Grade 6 CF, 6.3).*
- *The opposite of a positive number is negative and the opposite of a negative number is positive (Grade 7 CF, 7.1).*

Although some repetition seems to be intentional, this too creates problems insofar as the repeated content is not equally important for all grade levels. For example, the following *Understanding the Standard* guidance about fractions is included near the beginning of the CF for grades 3–7, even though fractions are not the main focus in the later grades:

> *Proper fractions, improper fractions, and mixed numbers are terms often used to describe fractions. A proper fraction is a fraction whose numerator is less than the denominator. An improper fraction is a fraction whose numerator is equal to or greater than the denominator. An improper fraction may be expressed as a mixed number. A mixed number is written with two parts: a whole number and a proper fraction (e.g., 3 and 5/8). Fractions can be positive or negative (Grade 3 CF, 3.2 through Grade 7 CF, 7.1).*

A second significant shortcoming is the lack of explicit fluency expectations for multi-digit whole number operations (addition, subtraction, multiplication, and division). Although fluency is expected for addition and subtraction (grade 2) and multiplication and division facts (grade 4), it is not a stated expectation for whole number operations. Furthermore, the standard algorithm for each operation is not specifically referenced in either the SOL or CF. (The exception is the CF for a third-grade standard pertaining to Computation and Estimation (3.4))

The third fundamental weakness is the lack of emphasis on developing conceptual understanding within the number and number sense and computation and estimation standards.

In general, the Virginia standards focus on the mechanics of computing, estimating, or performing operations.

For example, consider this fourth-grade standard:

- *The student will…*
  - *Demonstrate fluency with multiplication facts through 12 × 12, and the corresponding division facts;*
  - *Estimate and determine sums, differences, and products of whole numbers;*
  - *Estimate and determine quotients of whole numbers, with and without remainders; and*
  - *Create and solve single-step and multistep practical problems involving addition, subtraction, and multiplication, and single-step practical problems involving division with whole numbers (4.4).*

This emphasis on computation and application is appropriate. However, the standards would be stronger if they also expected students to "explain" and "understand." For example, in Algebra II we learn that "the process of solving equations can lead to extraneous solutions" (Algebra II CF, AII.3). Ideally, the standard would ask students to explain when and why this statement is true.

The insufficient emphasis on conceptual understanding is detrimental to the development of some mathematical topics. For example, because the concept of fractions is not introduced (in kindergarten) as numbers on the number line, the connection to decimal numbers is not easily established in the later grades (see 4.3.d and 5.2.a). Addition and subtraction of fractions are also poorly developed.

Another consequence of the inattention to conceptual understanding is an overemphasis on practical applications. Up to a point, such an emphasis is desirable, but the standards seem to overlook the significance of another class of rich mathematical problems—namely, the purely abstract kind that do not involve real-world contexts. (For example: "What kind of fractions terminate when they are expressed in decimal form? Why?") Such problems provide a healthy diet for developing deep and solid conceptual understanding.

# Communication

Virginia's approach to communication is a double-edged sword. On the one hand, it provides teachers ample guidance for implementing the standards. But on the other hand, this guidance is sometimes overwhelming, inconsistent, and repetitious.

## + Communication Strengths

An expansive and teacher-friendly resource like the CF has the potential to help teachers connect the core SOLs to instruction.

The two-column format of the CF is also useful because it separates the underlying mathematical concepts from the knowledge and skills that students are expected to master. This is an excellent way to unpack the standards.

## − Communication Weaknesses

The CF contains an eclectic collection of instruction-related elements that try to do too much. Because they are part definition, part background information, and part pedagogical support, the purpose of these elements is not always clear.

For example, consider this assortment of elements for third-grade educators teaching Computation and Estimation (reviewer annotations in bold):

- *An algorithm is a step-by-step method for computing.* [Definition]
- *The least number of steps necessary to solve a single-step problem is one.* [???]
- *Extensive research has been undertaken over the last several decades regarding different problem types. Many of these studies have been published in professional mathematics education publications using different labels and terminology to describe the varied problem types.* [Background information]
- *Students should experience a variety of problem types related to multiplication and division. Some examples are included in the following chart:* [Examples]

In most states, this sort of information can be found in an appendix, or in a footnote, or in a mathematical glossary.

And their inclusion blurs the focus of the CF. By definition, academic standards should be about what students do, not what teachers do.

Finally, some SOLs are confusing because they combine two or more expectations in an awkward way. The standard lists six trigonometric functions, each of which is to be found in two ways. As a single standard, it is unwieldy and challenging to parse. For example, consider the following Trigonometry standard:

> *The student, given a point on the terminal side of an angle in standard position, or the value of the trigonometric function of the angle, will determine the sine, cosine, tangent, cotangent, secant, and cosecant of the angle (T.1).*

# Recommendations

1. Specify fluency expectations for multi-digit operations involving whole numbers and decimals, and reference the standard algorithms as appropriate.
2. Make conceptual understanding more explicit in the SOL. Revise and rearrange the CF to reflect this emphasis on conceptual understanding, and make explicit the coherence and progression of the SOL.
3. Move any and all pedagogical suggestions, references to research, and definitions to the appendix of the CF (or to a separate document)..
4. Clean up the CF by removing or clarifying unintentional redundancies, non-essential examples, and inconsistencies.

## = Bottom Line

Targeted revisions recommended along with a focus on implementation of these standards.

## Documents Reviewed

Mathematics Standards of Learning for Virginia Public Schools (SOL) and the accompanying Curriculum Frameworks (CF), 2016, accessed from http://www.doe.virginia.gov/testing/sol/standards_docs/mathematics/2016/index.shtml.

Appendix A

# Reviewer Biographies

## ELA Reviewers

### Diane Barone (Lead Reviewer)

Diane Barone is a foundation professor of literacy at the University of Nevada, Reno, where she teaches courses in literacy and qualitative research method. She is currently editor of The Reading Teacher and previously served as the editor of Reading Research Quarterly. She has served on the IRA Board of Directors and won the John Manning Award for Service to Public Schools in 2010. Professor Barone has conducted two longitudinal studies of literacy development: 1) a four-year study of children prenatally exposed to crack/cocaine and 2) a seven-year study of children, predominantly English language learners, in a high-poverty school. She has had articles published in journals such as Reading Research Quarterly, Journal of Literacy Research, Elementary School Journal, The Reading Teacher, Gifted Childhood Quarterly, and Research in the Teaching of English, and has written several books on literacy. She has just completed terms as a board member of the International Reading Association and the National Reading Conference. She was inducted into the Reading Hall of Fame in 2014.

### Linda Dixon

Linda Dixon is an English language arts teacher with nineteen years of classroom experience. She holds a bachelor's degree in Environmental Science and a Master of Arts in Education (with an emphasis in Curriculum and Instruction) from the University of Redlands, and has done post-graduate work in social emotional learning, English learner instruction, and gifted education. She has worked for the California Department of Education on determining cut scores for the ELPAC (English Language Proficiency Assessment California), range-finding for fourth-grade CST writing, and item alignment using California English Language Development standards. She served on a Smarter Balanced Assessment Consortium panel, creating an instructional playlist for their Digital Library. Since December 2015 she has worked as a content reviewer for nonprofit Edreports.org, conducting reviews of English language arts textbook adoptions. She is currently teaching fourth grade in the Colton Joint Unified School District in Colton, CA.

### Douglas Fisher

Douglas Fisher, PhD, is professor of Educational Leadership at San Diego State University, where he previously served in the Department of Teacher Education since 1998, and is a teacher and administrator at Health Sciences High and Middle College. He is a board member of the International Reading Association and a past board member of the Literacy Research Association. He has served as a teacher, language development specialist, and administrator in public schools and nonprofit organizations, including eight years as the director of professional development for the City Heights Collaborative, a time of increased student achievement in some of San Diego's urban schools. Dr. Fisher is a member of the California Reading Hall of Fame and the recipient of an International Reading Association Celebrate Literacy Award and a Christa McAuliffe award for excellence in teacher education, and was a co-recipient (with Nancy Frey) of the 2004 Kate and Paul Farmer award from the National Council

of Teachers of English. In 2011, his book Implementing RTI with English Learners won the innovation award from the Academy of Educational Publishers. He has published widely on school improvement and has written several books on the topic.

### Nancy Frey

Nancy Frey, PhD, is a professor in the Department of Educational Leadership at San Diego State University. She had previously served in the School of Teacher Education, beginning in 2003, as a professor of literacy. She is the recipient of the Christa McAuliffe award for excellence in teacher education from the American Association of State Colleges and Universities and the 2008 Early Career Achievement Award from the National Reading Conference, and was a co-recipient (with Doug Fisher) of the 2004 Kate and Paul Farmer award from the National Council of Teachers of English. Dr. Frey has published numerous articles and co-authored several books on literacy, formative assessment, instructional design, data-driven instruction, and brain-based learning. Her research interests lie in school-wide practices, literacy interventions, and the leadership of teachers and administrators who create these positive changes in the lives of young people. She is a credentialed special educator, reading specialist, and administrator in California, and has taught at the elementary, middle, and high school levels in Florida and California for two decades. She is a teacher-leader at Health Sciences High and Middle College.

### Timothy Shanahan

Timothy Shanahan is Distinguished Professor Emeritus at the University of Illinois at Chicago, where he was founding di¬rector of the UIC Center for Literacy. Previously, he was director of reading for the Chicago Public Schools. He is author/editor of more than two hundred publications, and his research emphasizes the connections between reading and writing, literacy in the disciplines, and improving reading achievement. Professor Shanahan is past president of the International Literacy Association. He served as a member of the Advisory Board of the National Institute for Literacy under Presidents George W. Bush and Barack Obama, and he helped lead the National Reading Panel, convened at the request of Congress to evaluate research on the teaching reading—a major influence on reading education. He chaired two other federal research review panels: the National Literacy Panel for Language Minority Children and Youth, and the National Early Literacy Panel, making him the only scholar to serve on all three national literacy research panels. Professor Shanahan helped write the Common Core State Standards. He was inducted into the Reading Hall of Fame in 2007, and is a former first-grade teacher.

## Math Reviewers

### Solomon Friedberg (Lead Reviewer)

Solomon Friedberg is James P. McIntyre Professor of Mathematics at Boston College. A well-known researcher in number theory and representation theory and a Fellow of the American Mathematical Society, Dr. Friedberg served as chair of the BC Mathematics Department for nine years and led the development of a new and highly regarded doctoral program. Dr. Friedberg has been involved in pre-collegiate mathematics education since the 1990s. He has been an editor of the CBMS book series Issues in Mathematics Education from 2006 on and serves on the National Academy of Science's U.S National Commission on Mathematics Instruction. He also received an award for Distinguished College or University Teaching from the Mathematical Association of America in 2009, and is chair of the AMS-MAA Joint Committee on TAs and Part-Time Instructors. He is co-principal investigator for a current National Science Foundation-funded project, "Exemplary Mathematics Educators for High-need Schools," through which Boston College partners with MƒA Boston in support of teaching fellows.

### Juliana Belding

Juliana Belding is a professor of the Practice in Mathematics at Boston College. Her primary interests are mathematics teaching and learning at the undergraduate and K–12 level. At BC, she teaches math courses ranging from those for pre-service teachers to early level math majors, and she works with the training and mentoring of graduate student instructors. Previously, she was a Preceptor in Math at Harvard University, where she taught introductory courses and worked on a grant to developed multi-media case studies of calculus in other fields ("Calculus Applied!"). She received her PhD in algebraic number theory and cryptography at the University of Maryland in 2008. In the area of teacher education, Professor Belding has designed

and facilitated a variety of professional development on mathematical investigations and habits of mind. Most recently, she worked with an NSF-funded grant for Pittsburgh Public Schools, "Designing for Equity by Thinking about Mathematics." Previously, she led a seminar for Math for America, Boston, and Boston University's Math Teaching Scholars on making sense of the Common Core State Standards in the classroom. She is a founding member of the Boston Math Teachers' Circle, has led study groups for middle and high school math teachers in Cambridge Public Schools, and served as counselor and assistant director of the PROMYS for Teachers program at Boston University. At the undergraduate level, she is interested in increasing student persistence in STEM via the development of resources like the open online edX course "Calculus Applied!" She currently serves on the Mathematical Association of America committee on Assessment.

## Andrew Chen

Dr. Andrew Chen served on the Common Core Standards Development Team in mathematics and frequently consults with education research institutions, including the Institute for Education Science at the U.S. Department of Education and Achieve, Inc. A former professor and principal research scientist at MIT, he is the founder and president of EduTron Corporation. He is currently on the advisory board of the National Council on Teacher Quality and the Mathematics and Science Advisory Council for the Massachusetts Board of Education. He was an adviser for the Massachusetts 2008 Guidelines for the Mathematical Preparation of Elementary Teachers. Dr. Chen provides high-quality professional development in mathematics and science to teachers at all levels through Intensive Immersion Institutes. He works with school districts and school administrators to increase their capacity to support excellent mathematics and science instruction. He also works with higher education institutions to develop rigorous and effective pre-service and in-service offerings in mathematics and science, and continues to teach and do research in physics.

## Francis (Skip) Fennell

Francis (Skip) Fennell, PhD, is the L. Stanley Bowlsbey Professor of Education and Graduate and Professional Studies at McDaniel College in Maryland. A mathematics educator who has experience as a classroom teacher, principal, and supervisor of instruction, he is a past president of the National Council of Teachers of Mathematics (NCTM) and the Association of Mathematics Teacher Education (AMTE). Dr. Fennell is widely published in professional journals and textbooks related to elementary and middle-grade mathematics education and has played key leadership roles in the Research Council for Mathematics Learning, the Mathematical Sciences Education Board, the National Science Foundation, the Maryland Mathematics Commission, the United States National Commission for Mathematics Instruction, the Association for Mathematics Teacher Educators, and the National Mathematics Advisory Panel. He was a writer for the Common Core State Standards in Mathematics. He has received numerous honors and awards, including Maryland's Outstanding Mathematics Educator (1990), McDaniel College's Professor of the Year (1997), the Glenn Gilbert National Leadership Award from the National Council of Supervisors of Mathematics, the CASE-Carnegie Foundation Professor of the Year – Maryland (1997) and the AMTE Distinguished Outstanding Teacher Educator Award for Excellence in Service (2010).

## Roger Howe

Roger Howe is the Curtis D. Roberts Professor of Mathematics Education in the College of Education and Human Development at Texas A&M University. He assumed this position in 2106, after retirement from Yale University, where he was a member of the Yale Mathematics Department for over forty years, and is now the William Kenan Jr. Professor of Mathematics, Emeritus. Beginning in the late 1990s, Dr. Howe served on a multitude of committees studying mathematics education, including several that produced major reports on mathematics education. He has reviewed texts and instructional materials for several publishers and curriculum developers. He served on the Committee of Education for the American Mathematical Society, the Steering Committee for the Park City/IAS Mathematics Institute, the U.S. National Commission on Mathematics Instruction (2006–2016), and the executive committee of the International Commission on Mathematics Instruction (ICMI) (2008–2016). In 1997 and 1998, Dr. Howe served as a Phi Beta Kappa Visiting Scholar. He is a member of the American Academy of Arts and Sciences, the National Academy of Sciences, and fellow of the American Mathematical Society; he received their Award for Distinguished Public Service in 2006. Dr. Howe's mathematical research investigates symmetry and its applications. His work in mathematics education is directed toward clarifying the conceptual development of mathematical ideas through the K–12 curriculum. He has focused especially on place value, the role of word problems, and productive use of the number line.

Appendix B

# English Language Arts Review & Scoring Criteria

Below are the content-specific criteria for ELA standards upon which states were evaluated for their "Content" score (see also the *Scoring Criteria* that follows).

## Content-Specific Criteria

### Elementary School (Grades K–5)

*Reading*

1. The standards delineate explicit and systematic outcome expectations in foundational skills (e.g., phonemic awareness, phonics, fluency, vocabulary) and comprehension.
2. The standards outline specific expectations for reading and for analyzing narrative and informational texts[1] (e.g., recognizing and interpreting genres and subgenres; organizational and/or argument structures; narrative elements; stylistic devices).
3. The standards reflect the importance of knowing specific works of outstanding literature and culturally significant informational texts.
4. The standards describe the quantitative and qualitative text complexity[2] of both narrative and informational texts to be studied and include lists (authors and/or titles), sample passages, and/or commentary that serve as exemplars of the levels of complexity required.
5. The standards require students to analyze and evaluate information presented in multimedia formats (e.g., the effect of various visual and aural techniques; how information presented in print is different from that which is presented through the use of multimedia).

*Writing*

1. The standards delineate explicitly the foundational skills of writing (e.g., printing, handwriting, keyboarding, spelling) as well as providing a clear progression of expectations that address the characteristics and quality of writing products that students must learn to produce (e.g., organization of ideas and focus; introduction, body, and conclusion; elements of a paragraph; elaboration; accuracy).
2. The standards require students to recognize, explain, and produce writing that reflects the defining characteristics of various grade-appropriate writing genres and subgenres, including specific literary elements or organizational structures and stylistic devices.

1. Informational texts include biographies, autobiographies, historical books, technical texts, and literary nonfiction.
2. Measures of quantitative text complexity include formulas for calculating word frequency and sentence and word length. Qualitative measures include the language, structure, and knowledge demands of a text.

3. The standards describe or reference the use of specific criteria for evaluating pieces of writing (e.g., logically organized and detailed genre- or prompt-specific rubrics) that include examples regarding the quality of writing expected.
4. The standards specify expectations for the correct use of Standard English, describing a grade-appropriate facility with the parts of speech, sentence structure, usage, and mechanics appropriate to the grade level (e.g., nouns, verbs, adjectives, adverbs, conjunctions, prepositions, and nominative/objective/interrogative pronouns; sentence types; complete/incomplete sentences; subject/verb (S/V) agreement; initial, internal, and ending punctuation; and basic spelling rules, such as plurals, contractions, and inflections).
5. The standards specify the expectations for using technological tools to produce and revise writing, including word processing software, spell checkers, etc.

### *Listening and Speaking*

1. The standards clearly address active listening and effective speaking skills (e.g., summarizing information presented orally, asking and answering relevant questions).
2. The standards address the ability to make formal oral presentations (e.g., recitation; story retelling; and sequencing).
3. The standards describe or reference the use of specific criteria for evaluating oral presentations (e.g., content, organization, and presentation style).
4. The standards include specific expectations for participation in group discussions (e.g., turn-taking and applying agreed-upon rules for decision making).
5. The standards require that students learn about multimedia techniques for presenting information.

### *Research*

1. The standards require students to learn to conduct research, outlining specific expectations for the essential components of the process (e.g., identifying or finalizing a research question, locating information, evaluating and compiling information, using evidence from text to present their ideas and findings, and acknowledging sources using a standard format).
2. The standards specify that students be able to use and evaluate digital and multimedia sources and technological within the research process.

## Middle School (Grades 6–8)

### *Reading*

1. The standards address vocabulary development (e.g., knowledge of word meanings, roots and affixes, context clues, connotation and denotation, figurative language, and use of the dictionary for clarifying multiple meanings, etymology, and pronunciation).
2. The standards describe specific expectations for reading and analyzing narrative and informational texts—including specific requirements for mastering particular literary genres and subgenres and rhetorical structures (e.g., recognizing and interpreting genres, subgenres, and literary elements; organizational and/or argument structures; narrative elements; stylistic devices).
3. The standards reflect the importance of knowing specific works of outstanding American literature that reflect our common heritage, world literature that expands students' understanding of different human experiences, as well as culturally significant informational texts.
4. The standards describe the quantitative and qualitative text complexity of both narrative and informational texts to be studied and include lists (authors and/or titles), sample passages, and/or commentary that serve as exemplars of the levels of complexity required.
5. The standards specify that students learn to deal with text features unique to the different disciplines and that they develop reading skills or approaches that are appropriate to the specialized reading demands of the disciplines (e.g., determining theme in literary works, sourcing information in history, comparing prose and graphic sources in science reading).
6. The standards require students to analyze and evaluate information presented in multimedia formats (e.g., how information presented in print is different from that which is presented through the use of multimedia, noting what is conveyed through the use of various visual and aural techniques, such as bias and propaganda).

### *Writing*

1. The standards delineate expectations for writing that address the characteristics and quality of writing products appropriate to each grade level and there is a clear progression from grade to grade that demonstrates increased rigor (e.g., increasingly sophisticated understanding of audience and purpose, clear organization and consistent focus, development of ideas through multi-paragraph essays, use of transitions, elaboration, accuracy).
2. The standards require students to interpret and produce writing that reflects the defining characteristics of various writing genres and subgenres (e.g., argument, rhetorical, narrative, and informational).
3. The standards describe or reference the use of specific criteria for evaluating writing (e.g., logically organized and detailed genre- or prompt-specific rubrics) that include examples regarding the quality of writing expected.
4. The standards specify expectations for the correct use of Standard English, describing a grade-appropriate facility with the parts of speech, sentence structure, usage, and mechanics appropriate to the grade level (e.g., parts of the verb; interjections, possessive/demonstrative/relative/indefinite pronouns; tenses; analysis of sentence structure; types of phrases and clauses; fragments and run-on sentences; and facility with mechanics grounded in understanding of sentence structure).
5. The standards require students to learn to write in ways that reflect the specified communication demands of the various disciplines (e.g., history, mathematics, science, literature).
6. The standards specify the expectations for using technological tools to produce and revise writing, including word processing software, spell checkers, etc.

### *Listening and Speaking*

1. The standards clearly address active listening and effective speaking skills (e.g., give, restate, and execute multi-step directions; convey ideas orally and interpret spoken ideas; make inferences from spoken information; ask and answer clarifying questions).
2. The standards address the ability to make formal oral presentations (e.g., recitation, informative and persuasive presentations that offer supporting details and evidence, and address anticipated counterclaims and include a call to action when appropriate).
3. The standards describe or reference the use of detailed criteria for evaluating formal oral presentations.
4. The standards include specific expectations for participation in group discussions (e.g., designation of roles and eliciting and considering suggestions).
5. The standards require that students use multimedia techniques to present information.

### *Research*

1. The standards require that students learn to conduct research, specifying expectations for the essential components of the inquiry process (e.g., identifying and refining a research question; locating information; evaluating the quality of information/sources; selecting information that supports a thesis; using evidence from text to present their ideas and findings; citing sources correctly using standard guidelines; avoiding plagiarism).

## High School (Grades 9–12)

### *Reading*

1. The standards address vocabulary development and skills for building discipline- specific vocabulary (e.g., applying knowledge of roots and affixes to help determine meanings of words; applying knowledge of context clues to determine word meanings; tracing etymology; determining shades of meaning).
2. The standards describe specific expectations for reading and analyzing narrative and informational texts—including specific requirements for mastering particular literary genres and subgenres and rhetorical structures (e.g., analyzing specific literary elements for the genres/subgenres, the effectiveness of rhetorical techniques, and the manipulation of stylistic devices; describing the truth and/or validity of an argument; recognizing and explaining the presence of fallacious reasoning).

3. The standards reflect the importance of knowing specific works of outstanding American literature that reflect our common literary heritage, world literature that expands students' understanding of different human experiences, as well as culturally significant informational texts.
4. The standards describe the quantitative and qualitative text complexity of both narrative and informational texts to be studied and includes lists (authors and/or titles), sample passages, and/or commentary that are exemplars of the levels of complexity required.
5. The standards specify that students learn to deal with text features unique to the different disciplines and that they develop reading skills or approaches that are appropriate to the specialized reading demands of those disciplines (e.g., determining theme in literary works, sourcing information in history, comparing prose and graphic sources in science reading).
6. The standards require students to analyze and evaluate information presented in multimedia formats (e.g., noting instances of manipulation, bias, propaganda, and potential fallacies).

### *Writing*

1. The standards delineate expectations for writing, including rhetorical and argumentative writing, that address the characteristics and quality of writing products appropriate to the grade level (e.g., strong organization and development of ideas, facility with selection and blending of genres appropriate to audience and purpose, the use of sophisticated transitions, active rather than passive voice, and other stylistic elements for rhetorical effect).
2. The standards require students to analyze and produce writing that reflects the defining characteristics of writing genres and subgenres (e.g., argumentation, explanatory).
3. The standards describe or reference the use of specific criteria for evaluating writing (e.g., logically organized and detailed genre- or prompt-specific rubrics) that include examples regarding the quality of writing expected.
4. The standards specify expectations for the correct use of Standard English, describing a grade-appropriate facility with the parts of speech, sentence structure, usage, and mechanics (e.g., demonstrate control of sentence structure, usage, and mechanics).
5. The standards require students to learn to write in ways that reflect the specified communication demands of the various disciplines (e.g., history, mathematics, science, literature).
6. The standards require that students use multimedia techniques to prepare and present information.

### *Listening and Speaking*

1. The standards clearly address active listening and effective speaking skills (e.g., interpret complex information and ideas presented orally, convey complex information or ideas orally).
2. The standards address the ability to make formal oral presentations (e.g., recitation and complex informative or persuasive oral presentations that require a logical structure, well-chosen supporting evidence/details, skillful rhetorical techniques, and a strong presentation style).
3. The standards describe or reference the use of detailed criteria for evaluating formal oral presentations.
4. The standards include specific expectations for participation in group discussions (e.g., tolerating ambiguity, building on the ideas of others, and reaching consensus).

### *Research*

1. The standards require students to learn to conduct research, outlining specific expectations for the essential components of the process (e.g., identifying and refining a research question; locating information; evaluating the quality of information/sources; selecting information and evidence that supports a thesis; excluding extraneous information; presenting findings in a format appropriate for the audience and purpose; citing sources correctly in a standard format; avoiding plagiarism).

# Scoring Criteria

Standards are evaluated in two categories: "content and rigor" and "clarity and specificity." Based on the degree to which the standards included the content above, states could earn up to 7 points for content and rigor as summarized below.

## Content & Rigor

### 7 Points

Standards meet all of the following criteria:

- The standards are of high quality in terms of the content chosen. Categories of content deemed crucial include: Foundational Knowledge; Comprehension; Vocabulary; Language; Fluency; Writing; Text Complexity; Research; Familiarity with important Literary/Cultural Works; and Disciplinary Literacy.
- The standards focus on learning outcomes, as opposed to learning processes. (Less that 5 percent of the standards focus on learning processes.)
- The standards connect to content standards in other disciplines such as art, science, and social studies.
- The content identified by the standards is well explained.
- Good decisions are made about what content should be omitted. (Less than 5 percent of the content in the standards is unnecessary or superfluous.)
- The standards do not overemphasize topics of little importance or underemphasize topics of great importance.
- The level of rigor is appropriate for the targeted grade level(s), and these expectations are clearly articulated. Students are expected to learn the content and skills in a sensible order and at an increasing level of difficulty.
- The standards articulate the level of text complexity expected of students and provide text exemplars of this level of complexity.
- The standards are specific about the genres and subgenres that students need to master, including particular literary elements relevant to those genres/subgenres.
- The standards are specific about the types of literature and informational text that students should know, including specifying some particular texts/authors that students should be familiar with.
- The standards, taken as a whole, define core literacy for all students in the subject under review; at the same time, the standards that run through grade 12 are sufficiently challenging to ensure that students who achieve proficiency by the final year of high school will be college- or career-ready.
- The standards do not overemphasize the importance of students' life experiences or "real-world" problems. They do not embrace fads, suggest political bias, or teach moral dogma. They do not imply that all interpretations are equally valid (regardless of logic or the adequacy of supporting evidence). The standards also avoid other major subject-specific problems identified by the reviewers.

### 6 Points

Standards fall short in one or more of the following ways:

- Some content (as specified in the content-specific criteria) is missing (approximately 5 percent and up to 20 percent).
- The standards include learning outcomes. Approximately 6 percent to 15 percent of the standards focus on learning processes rather than learning outcomes.
- The standards haphazardly connect to standards in other disciplines such as art, science, and social studies.
- Some of the content in the standards is unnecessary (approximately 5 percent and up to 20 percent).
- The level of rigor is appropriate for most of the targeted grade level(s), and these expectations are articulated. Students are expected to learn the content and skills in a sensible order and at an increasing level of difficulty.
- The standards are inconsistent in their coverage of the text complexity expected of students.
- The standards specify types of literature and informational text (e.g., poetry, American literature) that should be known by students, but without indicating any specific texts or authors.

- The standards do not fully distinguish between more- and less-important content and skills (i.e., importance is neither expressly articulated nor conveyed via the number of standards dedicated to particular topics). In other words, the standards overemphasize one or two topics of little importance or underemphasize one or two topics of great importance.
- Standards at particular grade levels are not as rigorous as they should be, or are too rigorous (i.e., expectations are slightly too high or too low).
- There are minor problems or shortcomings (e.g., one or more of the problems listed in the last paragraph under the 7-point score affects the standards in a small way, or there are other minor subject-specific problems).

## 5 Points

Standards fall short in one or more of the following ways:

- Crucial content is missing (approximately 20 percent and up to 35 percent).
- Standards include learning outcomes (approximately 20 percent, but less than 50 percent, of the standards focus on learning processes rather than learning outcomes).
- While most of the appropriate content is covered by the standards, the content is nonetheless covered in a manner that is not satisfactory (i.e., the standards cover the right material but do not cover that material robustly; thus, the material is shortchanged in some way).
- Some of the content in the standards is unnecessary (approximately 35 percent).
- The level of rigor is appropriate for about half of the targeted grade level(s) and these expectations are not always clearly articulated. Students are expected to learn the content and skills in a sequential order and at an increasing level of difficulty, but this order and increasing level of difficulty are not always articulated.
- The standards are inconsistent in their descriptions of text complexity expected of students.
- Standards do not distinguish between more- and less-important content and skills (i.e., importance is not articulated or conveyed in any way). The standards often overemphasize topics of little importance or underemphasize topics of great importance.
- The standards specify only that students should be familiar with literary and informational texts.
- Standards generally need to be more or less rigorous than they are at certain grade levels (i.e., expectations are too high or too low).
- There is an important shortcoming (perhaps one of the problems listed in the last paragraph of the 7-point score, or there are other subject-specific problems).

## 4 Points

Standards fall short in one or more of the following ways:

- At least 35 percent and up to 50 percent of crucial content is missing.
- Some of the content in the standards is unnecessary (at least 35 percent, and up to 50 percent).
- The level of rigor is appropriate for less than half of the targeted grade level(s), and these expectations are not always clearly articulated. Students are expected to learn the content and skills in a sequential order and at an increasing level of difficulty, but this order and increasing level of difficulty are infrequently articulated.
- More than 50 percent of the standards focus on learning processes rather than learning outcomes.
- The standards are inconsistent in their descriptions of the text complexity expected of students.
- There are a few critical shortcomings (as listed above).

## 3 Points

Standards fall short in one or more of the following ways:

- At least 50 percent of crucial content is missing.
- The majority of the content in the standards is unnecessary.
- The standards focus on learning processes rather than outcomes.
- The level of rigor is inappropriate for more than half of the targeted grade level(s) and these expectations

are not clearly articulated. Students are expected to learn the content and skills in a sequential order and at an increasing level of difficulty, but this order and increasing level of difficulty are infrequently articulated.

- The standards do not mention text complexity expected of students.
- There are serious problems, shortcomings, or errors in the standards, although the standards have some redeeming qualities and there is some evidence of rigor.

### 2 Points

Standards fall short in one or more of the following ways:

- At least 50 percent of crucial content is missing.
- The majority (approximately 80 percent) of the content in the standards is unnecessary.
- There are several serious problems, shortcomings, or errors (as listed above).

### 1 Point

Standards fall short in one or more of the following ways:

- At least 80 percent of crucial content is missing.
- At least 80 percent of the content in the standards is unnecessary.

There are numerous problems, shortcomings, or errors (as listed above).

### 0 Points

Standards fall short in one or more of the following ways:

- The content of the standards does not address or barely addresses the subject-specific content expectations.
- The content is poorly chosen and fails to provide the level of rigor appropriate for the targeted grade level(s).
- Content is full of problems, shortcomings, and errors (as listed above).

## Clarity & Specificity

Standards should be clearly written and organized. The purpose of standards is to communicate educational goals to students, parents, and educators. To meet the needs of all of these audiences, standards must be clearly written, without jargon, and must be laid out in a manner that makes them easy to follow and understand.

States could earn up to three points for clarity and specificity, as explained below.

### 3 Points

Standards are coherent, clear, and well organized. The scope and sequence of the standards are apparent and sensible. They provide solid guidance to users (students, teachers, curriculum directors, test developers, textbook writers, etc.) as to the content knowledge and skills required to be college- or career-ready. The right level of detail is provided.

The document(s) are written in prose that the general public can understand and are mostly free from jargon. The standards describe things that are measurable (i.e., can lead to observable, comparable results across students and schools). The standards as a whole clearly illustrate the growth expected through the grades, and the organization of the standards across reading, writing, and oral language are clearly specified.

### 2 Points

The standards are somewhat lacking in coherence, clarity, or organization.

The scope and sequence of the standards is not completely apparent or sensible. The standards do not provide a complete guide to users as to the content knowledge and skills required to be college or career ready (i.e., as a guide for users, there are shortcomings that were not already addressed by the content and rigor score). The standards provide insufficient detail. There is some connection between the organization of the different components of the language arts (reading, writing, speaking, listening); perhaps there are connections between reading and writing or speaking and listening.

The prose is generally comprehensible but there is some jargon and some vague or unclear language. Some standards are not measurable.

### 1 Point

The standards are somewhat coherent, clear, and organized. They offer limited guidance to users (students, teachers, curriculum directors, textbook writers, etc.) about the content knowledge and skills required to be college- or career-ready, but there are significant shortcomings (as a guide for users) that were not already addressed by the content and rigor score. The standards are seriously lacking in detail, and much of the language is vague enough to be unclear in what is being asked of students and teachers. There is no obvious connection among the components of the language arts.

### 0 Points

The standards are incoherent and/or disorganized. They are not helpful to users. They are sorely lacking in detail. Scope and sequence are not apparent.

## Overall Ratings

States can earn a total of 10 possible points. Final scores translate to the following overall ratings in Table B-1:

**Table B-1. Overall Ratings for State Reviews**

| Total Score | Overall Rating | Recommendation |
|---|---|---|
| 9–10 | Strong | Recommend implementation of these standards and the development of sample lessons that demonstrate their use. |
| 7–8 | Good | Recommend implementation of these standards with targeted revisions. |
| 5–6 | Weak | Weak. Recommend significant and immediate revisions. Standards are not suitable until and unless these revisions occur. |
| 0–4 | Inadequate | Highly recommend complete revision or rewrite. Do not recommend implementation of standards as they have critical shortcomings. |

Appendix C

# Mathematics Review & Scoring Criteria

Below are the content-specific criteria for Mathematics Standards upon which states were evaluated for their "Content" score (see also the *Scoring Criteria* that follows).

## Content-Specific Criteria

### Whole Numbers

Standards related to number and operations involving whole numbers should include standards that are foundational to the development of number sense. Such standards include those that involve counting, composing and decomposing whole numbers, place value, and comparing and ordering numbers. The pervasive role of place value should be articulated and emphasized. The standards should address developmental understandings and the related learning trajectories leading to computational fluency with addition/subtraction and multiplication/division, including access to and use of the commutative, associative, and distributive properties.

Within the elementary and middle school grades, students should be expected to:

- Demonstrate instant recall with single-digit addition and multiplication facts and their related subtraction and division combinations.
- Use a variety of representations as they develop understanding of whole numbers and whole number operations, including concrete models, drawings (e.g. arrays), and equations.
- Fluently add and subtract using strategies and algorithms based on place value, properties of operations, and/or the relationships between addition and subtraction, developmentally leading to understanding of and fluent use of the standard algorithm for addition and subtraction.
- Fluently multiply and divide using strategies and algorithms based on place value, properties of operations, and/or the relationships between multiplication and division, developmentally leading to understanding of and fluent use of the standard algorithm for multiplication and division.
- Solve problems that make use of whole number arithmetic.

### Fractions

Standards should develop number sense concerning fractions and decimals. Such standards include recognizing fractions and decimals when represented as part of a region, parts of a set, as the count of dividing a number of objects into groups, through the area model, and on the number line; fraction and decimal equivalence; comparing and ordering fractions and decimals; and placing various representations of numbers (whole numbers, fractions including fractions greater than 1, mixed fractions, and decimals) on a common number line. The standards should address developmental

understandings and the related learning trajectories leading to computational fluency with addition, subtraction, multiplication, and division of fractions and decimals, including access to and use of the commutative, associative, and distributive properties.

Within the elementary and middle school grades, students should be expected to:

- Use a variety of representations as they develop understanding of fractions and decimals, and operations involving fractions and decimals, including concrete models, the number line, drawings (e.g. area models), and equations.
- Fluently add, subtract, multiply, and divide fractions using strategies and algorithms based on equivalence, common denominators, properties of operations, and the relationships between the operations.
- Fluently add, subtract, multiply, and divide decimals using strategies and algorithms based on place value, properties of operations, and/or the relationships between the operations, developmentally leading to understanding of and fluent use of the standard algorithm for each of the operations.
- Extend understandings related to multiplication, division, and fractions to represent and solve problems involving ratio, rate, proportion, and percent.
- Solve problems that involve fractions and decimals.

Other standards that should be addressed, typically in middle and high school, include negative numbers, radicals, rational exponents, scientific notation, estimation (including the use of scientific notation to approximate, compare and calculate approximately with numbers, especially large and small numbers), rational numbers as repeating decimals, and the arithmetic of complex numbers.

## Measurement and Data

Standards related to measurement and data should engage students in applying concepts, understandings, and procedures involving these topics.

Within the elementary and middle school grades, students should be expected to:

- Estimate and measure lengths to the nearest centimeter, meter, inch, and foot.
- Know and understand the concept of area, relating it to the operations of multiplication and addition, and use and understand formulas to determine the area of a rectangle and triangle.
- Know and understand how to convert measurements within and between the metric and customary systems.
- Know and understand measurement applications related to time, liquid measures, weight, perimeter, surface area, volume, and angle measurement.
- Represent and interpret data using graphs and line plots.

## Algebra

Standards related to algebra, including those at the elementary school level, help to ensure college and career readiness. Rigorous K–12 standards must include algebra standards that cover the following essentials.

Standards covering linear equations should ensure that students:

- Extend understandings of ratio, rate, and proportion to linear equations.
- Solve equations and inequalities that are linear or involve the absolute value and know how to graph them.
- Know about slope and the various forms of linear equations and be able to write equations given different types of information, such as for a line through a given point with a given slope, a line through two points, or a line through a given point that is perpendicular to a given line.
- Solve a system of two linear equations in two unknowns.

Standards covering quadratic equations should ensure that students:

- Solve quadratic equations by factoring, completing the square, and using the quadratic formula, including complex solutions.
- Are able to graph y=ax2+bx+c, transform such a quadratic function into vertex form, find its vertex, its maximum or minimum, and its line of symmetry, and explain the geometric meaning of these quantities or objects.

In addition, students should be fluent with the four arithmetic operations with polynomials and be able to carry out elementary factoring, be able to use general function notation and multiple representations of functions (algebraic, graphical, verbal descriptions, and numerical), as well as exponential and logarithmic functions and their inverse relationship, and basic trigonometry and trigonometric functions. They should also be able to analyze suitable word problems using algebra.

## Geometry

Standards related to geometry provide opportunities in the elementary grades for spatial visualization, and in late middle and high school, opportunities for logical reasoning about geometric objects.

Within the elementary and middle school grades, students should be expected to:

- Identify and draw shapes and distinguish between the attributes of shapes.
- Identify properties of and classify two-dimensional and three-dimensional shapes.
- Graph points on the coordinate plane.
- Understand and apply the Pythagorean Theorem.

As part of the study of high school geometry, students should understand:

- Congruence, similarity, and symmetry.
- Proofs of standard results about angles of triangles and angles associated with lines crossing parallel lines, including perpendicular lines.
- Proofs of the standard theorems about congruence and similarity of triangles.
- Proofs of the standard theorems about circles, chords, tangents, and angles.
- How to do standard geometric constructions.

Students should also be able to solve problems involving two- and three-dimensional geometry.

## Statistics and Probability

Middle school and high school standards related to statistics and probability should engage students in the selection and use of appropriate statistical methods to analyze data, develop and assess inferences and predictions, and apply basic concepts of probability.

Within middle school and high school mathematics, students should be expected to:

- Read, analyze, and construct a variety of graphs and tables for univariate and bivariate data.
- Understand that responses to statistical problems should consider variability, and make inferences and justify conclusions from data.
- Determine and understand theoretical and experimental probabilities of simple and compound events, and use probability in the context of decision-making.
- Be able to carry out counting arguments involving combinations and permutations.

## The Development of Mathematical Thinking and Practices

Content standards at each level of instruction should regularly engage with ways of discussing, thinking about, and working on mathematics. In particular, problem solving, reasoning, mathematical precision, constructing mathematical explanations, modeling with mathematics, assessing the reasonableness of answers using estimation or other strategies, and the use of appropriate[1] tools should be consistently integrated with mathematical content.

1. The main focus in elementary school math is developing number sense and the mastery of arithmetic. In particular, students must be able to instantly add and multiply single-digit numbers and be fluent with use of the corresponding subtraction and division facts. They must also be able to add, subtract, multiply, and divide multi-digit whole numbers, decimals, and fractions without a calculator, and be able to select the best approach to efficiently carry out a computation. To support this expectation, calculators in elementary school should either not be used or else used only for specifically targeted lessons. At all grade levels (K–12), technology should not be used as a replacement for mathematical understanding or the development of computational skills, but rather to develop and support students' understanding.

# Scoring Criteria

Standards are evaluated in two categories: Content (Focus, Coherence, and Rigor) and Communication (Clarity, Specificity, and Access). Based on the degree to which the standards included the content above, states could earn up to 7 points for Content, as summarized below.

## Content: Focus, Coherence, Rigor

### 6 or 7 Points

Standards meet or exceed all or nearly all of the following criteria:

- The content domains and standards provided are appropriate for respective grade, course, and developmental levels.
- The standards show focus of content:
  - Critical topics for each grade level or course are clearly addressed. (These are outlined in the math-specific content criteria below.)
  - The standards do not include superfluous content topics nor overemphasize particular topics.
  - The balance between critical or more important mathematics standards within particular grades, levels and courses, and other, less important, standards within such grades or courses, is appropriate.
- Coherence across and within mathematical topics and coherence across grade levels and courses is evident within the standards. The standards build logically and sequentially from grade to grade and from elementary to middle to high school, reflecting the cumulative nature of mathematics.
- The level of rigor of the standards is appropriate for the targeted grade level(s) or course(s). The standards balance conceptual understanding, procedural skill and fluency and applications.
- The standards clearly address mathematical practices, i.e., ways of thinking about and working on mathematics, and integrate these practices within and across mathematical content domains and standards.
- The standards that run through grade 12 are sufficiently comprehensive and challenging to ensure that students who achieve proficiency by the final year of high school will be college- or career-ready.
- The standards avoid other major subject-specific problems identified by the reviewers.

### 4 or 5 Points

Standards fall short in one or more of the following ways:

- The content domains and standards provided are not always appropriate for respective grade, course, and developmental levels.
- The focus, coherence, or rigor of the standards is inconsistent. For example:
  - Critical topics for grade levels or courses are not always clearly addressed.
  - The standards sometimes overemphasize topics of little importance or underemphasize topics of substantial importance (for which importance is neither expressly articulated nor conveyed via the number of standards dedicated to particular topics).
  - Coherence across and within mathematical topics or coherence across grade levels and courses is uneven.
  - The level of rigor of the standards is not always appropriate for the targeted grade level or course.
- The standards sometimes fail to balance conceptual understanding, procedural skill and fluency and applications.
- The standards address mathematical practices, i.e., ways of thinking about and working on mathematics, but do not consistently integrate mathematical practices with the content standards.
- There are other particular problems or shortcomings related to the standards.

## 2 or 3 Points

Standards fall short in two or more the following ways:

- Several crucial content domains or standards are not provided.
- Some of the content domains and/or standards are unnecessary.
- The standards do not achieve focus.
- The standards lack coherence concerning one or more important mathematical topics.
- The standards lack sufficient rigor in their treatment of one or more important mathematical topics.
- There are very limited connections between the content standards and mathematical practices, i.e. ways of thinking about and working on mathematics.

There are serious shortcomings in the standards, as presented.

## 0 or 1 Points

Standards fall short in two or more the following ways:

- A significant number of crucial content domains and standards are not provided.
- Many of the content domains and/or standards are unnecessary.
- The standards do not achieve focus.
- The standards lack coherence.
- The standards lack sufficient rigor.
- The standards do not address mathematical practices, i.e. ways of thinking about and working on mathematics.
- There are critical problems, shortcomings, or mathematical errors in the standards.

## Communication: Clarity, Specificity, Access

Standards should be clearly written, organized, and easy to find and navigate. The purpose of standards is to communicate educational goals to students, parents, and educators. To meet the needs of all of these audiences, standards must be clearly written, without unnecessary jargon, and must be laid out in a manner that makes them easy to follow and understand. States could earn up to three points for clarity, specificity, and access as explained below.

## 3 Points

Standards are clear and well organized, suitably detailed, and can be easily accessed.

- The standards provide understandable and appropriate guidance to users (especially teachers and curriculum directors) about the content knowledge and mathematical practices communicated. The standards as a whole clearly communicate the growth expected throughout the grades.
- The standards describe expectations that are specific and measurable (i.e., can lead to observable, comparable results across students and schools). It is clear what is expected of students. An appropriate level of detail is provided.
- The organization of the standards, including print and online versions, is appropriate and accessible. Important support documents are identified and easy to find. The standards are written in prose that the general public can understand and are, for the most part, free from jargon.

## 2 Points

Standards are somewhat lacking in clarity, specificity or accessibility. They fall short of the criteria for 3 points in at least one of the following ways:

- The standards often, but not always, provide understandable and appropriate guidance to users (especially teachers and curriculum directors) about the content knowledge and mathematical practices communicated. The standards as a whole mostly communicate the growth expected throughout the grades, but there are shortcomings.

- The standards usually describe expectations that are specific and measurable (i.e., can lead to observable, comparable results across students and schools); however, other standards are not measurable. It is sometimes unclear what is expected of students. An appropriate level of detail is often provided, but sometimes the standards are either vague or overly prescriptive.
- The organization of the standards, including print and online versions, is not completely apparent and accessible. Important support documents, while extant, are not always identified and easy to find. The standards are written in prose that is generally comprehensible but there is some jargon and some vague or unclear language.

## 1 Point

Standards are frequently lacking in clarity, specificity or accessibility. They fall short of the criteria for 2 points in at least one of the following ways:

- The standards sometimes provide understandable and appropriate guidance to users (especially teachers and curriculum directors) about the content knowledge and mathematical practices communicated, but frequently do not. The standards as a whole communicate the growth expected throughout the grades in only a limited way.
- The standards sometimes describe expectations that are specific and measurable (i.e., can lead to observable, comparable results across students and schools); however, they frequently do not. It is often unclear what is expected of students. The standards are often either vague or overly prescriptive.
- The organization of the standards, including print and online versions and related supporting materials, is not apparent or seriously lacking in accessibility. The standards are difficult to understand.

## 0 Points

Standards are lacking in clarity, organization or accessibility. They fall short of the criteria for 1 point in at least one of the following ways:

- The standards and related support materials do not provide understandable and appropriate guidance to users (especially teachers and curriculum directors) about the content knowledge and mathematical practices communicated. The standards do not communicate the growth expected throughout the grades.
- The standards do not describe expectations that are specific and measurable.
- The organization of the standards, including print and online versions and related supporting materials, is badly flawed. Accessibility is difficult or limited. The standards are extremely difficult to understand.

# Overall Ratings

States can earn a total of 10 possible points. Final scores translate to the following overall ratings in Table C-1:

## Table C-1. Overall Ratings for State Reviews

| Total Score | Overall Rating | Recommendation |
|---|---|---|
| 9–10 | Strong | Recommend implementation of these standards and the development of sample lessons that demonstrate their use. |
| 7–8 | Good | Recommend implementation of these standards with targeted revisions. |
| 5–6 | Weak | Weak. Recommend significant and immediate revisions. Standards are not suitable until and unless these revisions occur. |
| 0–4 | Inadequate | Highly recommend complete revision or rewrite. Do not recommend implementation of standards as they have critical shortcomings. |